Data for paper

Tertiary birds from

Laguna Hills —

LACM Contrib Sci # 142

1968

In view of the topographic changes that have occurred since the fossils were collected, the following information concerning important sub localities was supplied by Mr. W. Earl Calhoun, whose watchfulness during building operations made possible much of the fossil collecting.

LACM locality 1945, best location on a north-south line between buildings 214 and 221, Avenida Majorca

LACM locality 65120, best location in street on Via Alhambra south of bldg 675, with fossil-bearing stratum running north & south. 65120 A, a pocket under site of bldg 829, south-east of main locality. 21

LACM 65121, best location at east corner of 1st parking turnin on Ronda Mendoza south of Via Los Altos

Mus of No. Arizona – material lent Aug 14, 1961
from Benson: Glen Canyon project

Swan(?) bones 62 65'21 (B.38) frag. up. end coracoid
whistling type

s

~~62 65'20 frag sternum~~ not anseriform

62 65'28 (B.7) prox end ulna

62 65'24 (B.26) frag. prox. end humerus

Other anseriform bones

62 65'23 – prox end tarsus (very slim) small goose
(not anabernicula)

62 65'13 (B.4) – prox end & part shaft carpometa.,
small goose (not anabernicula)

62 65'19 (B,3) dist end tibia (small goose

62 65'30 (B.22) lower end coracoid small goose or large duck
" 65'34 (B,23 " " " " " "
" 65'35 ((B.24 " " " " " "
" 65'32 (B,31) upper " " " " "
" 65'31 B,35') " " " " " "
" 65'33 (B.36) " " " " " "
" 65'36 (B,33) " " " " " "

62 65'27 (B,5') prox end carpometa – goose
(with excrescence on MI process
med. size

62 65'48 (B.21 dist end humerus

KEEP Complete list of bones from loc 1945 Laguna Hills ①
(3 sp.?)
5.8.67
3 PAGES (both sides?) 3)

p. 1 Tarsus Puffinus 58
38
R 2 Tarsus
P. 3 Tarsus (84 are unidents) 110
206
− 84
122

Puffinus 58?

Tarsus (dist end R large 17523) sp.
" (prox end large 17549) sp
" (" " 17538) P. priscus?
" (dist 3/4 mottled preservation 17543) sp.
13 " (" frag of shaft with mid. trochlea 17524) sp.
" (" " " " ——— 17524) sp.
" (prox half left 17582 (ref. P. calhouni n. sp.)
" " end ~~right~~ 17537) " " " ? n. sp.
" 4 mid sections shaft to be renumbered (now 17524) sp.
" frag dist sh.) ~~sp~~ no # sp.

Humerus (dist end right 17508) TYPE P. calhouni ? n. sp
" (" frag left 17539) ref. " " n sp.
" (" " right 17540) " " " ?, n. sp. water worn
9 " (prox frag. 17522) sp.
" (" " 17521) sp
" (sh near prox 17541) sp
" (dist end right 17548) P. priscus?
" (frag near prox – no #) sp
" " " dist 17522) sp

Ulna (upper part shaft 17547) P. priscus
" prox end right 17530 (ref P. calhouni ?)
" " " " 17532) sp
" " " right 17535 (P. calhouni ?
" " " left 17544 (" " ?)
" dist " left 17527 (" "
14 " " " right 17533) " "
" " " " 17526) " "
" " " left 17525) " "
" dist " right 17513) sp.
" (" " — 17519) sp
" (" 3/4 no #) sp.
" (" 1/2 no #) sp
" " 1/2 no #) sp

13
9
14
over 22
58

rad. 17515

Puffinus cont'd 5.8.67

3 { Carpometacarpus (dist frag, right 17546) sp.
" " " no #) sp 1 more?
" (prox end no #) sp.

4 { Radius (dist end 17515) sp.
" " " no # sp
" 2 prox " no # sp

4 { Coracoid (inc right 17534) ref calhouni?
" prx frag right 17728) " "
" prx frag left 17531) sp
" prx frag right 17529) ref calhouni?

3 { Scapula (artic end 17545) sp lt color
" " " 17520) sp
" " " 17512) sp

3 { Tibiotarsus (dist frag no #) sp
(" frag of sh no #) sp
" end 17517) sp

1 femur (dist end left 17516) sp

2 Wing phalanx (2 (1 comp, 1 inc. 17511 and 17514

1 quadrate 17510 (sp)

1 Cuneiform 17509 "

Complete list Laguna Hills fossil birds loc 1945 ②

5.8.67

p 2 Sulidae 28
over misc. 9
37

Sulidae ㉘

✓Miosula? Sula or Morus (large coracoid right 17569) Miosula?

— Microsula (prox end tarsus 17534 (

✓Miosula? Morus? (large prox end tarsus 17565 (worn) ✓ Miosula?

— Microsula (dist end humerus 17556) Type n. sp. ?

loc out x ~~[Morus? (large dist end tarsus 17580)] loc (65120)~~

✓Morus Morus? (large carpo, left 17566)

✓Miosula? " ? " carpo 1 dist shaft 17579)

✓Miosula? " ? 2" quadrate 17577, 17564 (worn✓)

— Microsula? dist half shaft 17555 carpometa

X Morus Morus? (dist end radius 17572)

✓Mio Sula? (" " " 17568)

XXX Morus Morus or Sula (3 dist end carpo. 17558, 17561, 17578)

— Microsula? " " (shaft humerus 17567

✓Miosula or Morus (tibia dist. 17570 2?

X Morus " [Sula] (cuneiform 17562)

XX Morus ~~[illegible]~~ " " (2 frags scap 17560, 17559)

? " " (large scap 17576) lt gray

? " " (phalanx 17571

X Morus " " (Tarsal troch 17575)

?? Sulid or cormorant prox end ulna small + tan 17563

✓Miosula? ~~Morus or Sula~~ Sulidae ? (sacrum no. #) (worn) ✓

loc out x ~~[" ? [dist ulna 17581 loc (65120)~~]

XX Morus Morus? 2 prox ends large radii 17574 and no #

✓Miosula? Sulidae dist water wornfrag femur no. # date?

X Morus Morus? frag dist. radius no. # (1.27.65

2 Fulmarus prox carpus NO# Type n. sp. gray
dist frag humerus no# n. sp gray
[" or Puffinus artic end scap no #] unident

2 Diomedea large phalanx no? D. calif?
med prox tarsus frag. sp?

1 Osteodontornis jaw frag 17557

4 Presbychen abavus? scap frag, 17551
" " prox tarsus 17552
" " " femur 17553
" " scap frag 17573 anserine?

6 Praemancalla Type
" carpus 15287
" " 15290
" coracoid 15289
" scap 15294
" frg Mandibl 15428

add onto p. 3

omit total here see alcidae sheet

misc unident 84
122
206

Sulids 28
✓ Fulmarus 3.?
✓ Albatross 2
Osteo. 1
Presbychen 4
✓ Puffinus 58
Alcidae 26
122

. 5.8.67

Laguna Hills LA 1945 ③
part of comp. list

27 Alcidae or Mancallidae No #'s

P. 2 Dubs 27
Lower nos 83
110

Mancallidae? tarsus prox no #
Alcidae? " sh no #
Mancallidae? small good ulna no #
" ? " prox end carpo no #
Alcidae? coracoid (closest Uria) no #
" 2 coracoids Cepphus? no #'s
" frag prox left ulna no # Cerorhinca?
" inc humerus (try Cepphus or Cerorhinca) - gray
" frag dist " sp? poor preserv.
" prox end ulna good preserv.
" prox " " frag
" dist " "
" frag. prox end femur (size ok uria aalge similar)
" Truly 2 coracoids
" " complete ulna
" " dist ½ humerus
" " " ½ ulna
" " " end carpo,
" frag coracoid

Praemancalla from other sheet 6 included in total
Alcidae - Manc. above

Birds Loc 1945

~~83~~ 84

Misc NO #'s

1 femur (small dist end no #)
1 scap (from fulmarus?) no #
9 phalanges
☆ 1 frag quadrate (tiny Sulid) 12.24.64
1 tarsal dist frag
2 vert water worn
1 vert well preserved
1 " frag tiny
1 " frag med
23 phalanges pedal
6 " wing
1 prox tibia tiny –
1 " femur small inc (in two pieces)
1 prox half radius tiny -
1 head femur tiny
~~1 frag prox end femur (with [illegible] radius) albid~~ (see over)
1 humeral sh tiny
5 dist frags carpomet,
1 " frag tibia (large
2 humeral dist frags
1 dist tibia frag
1 tarsal frag
1 dist rad frag
1 waterworn tarsal dist frag largish
2 prox frag carpomet
1 " " tibia
1 dist frag " (large
1 fibula
1 dist rad
5 trochleae tarsi
1 scap frag
☆ 1 unident scap good preserv.
☆ 2 " dist ulna " "
1 dist frag "
1 sh tibia
2 sh ulna
1 prox radius

at least 10 sps,
135+ misc to be checked
(about 35)
170?+0/-

Birds from new El Toro site Loc. 1945

"Leisure World"

Puffinus	59
Fulmarus	2
	61
6 sps	29
alcids	17
	107
	45?
	152

Sula – 19 [2, or 3 species]

Sula medium (1.18.65 and Dec 1964)
~~10~~ 2 prox ends radius
+4 1 Prox end tarsus
14 1 dist " radius
1 Dist " humerus
1 shaft " "
3 1 " "s carpometacarpus
1 prox " "

1 frag scapula

~~prox end radius~~
4 pedal phalanges

5 Sula, large
Prox. end tarsus (matrix strongly adhering)
Cuneiform
quadrate
upper end coracoid
Distal end tibiotarsus

1 Osteodontornis
fragment lower jaw (2 "teeth")
ht back tooth 4.8, ~~ht~~ at base 4.8; length at base of ant. tooth 6.8
ht incomp.

Depth jaw 10.5; br. jaw 5.55
distance bet. teeth 13.5
" from ending " , 19.0
very tiny "spur" bet. the two larger teeth.

~~2~~ Goose (Presbychen ?)
Prox end ~~femur~~ 1964 misc
Prox end tarsus L2100 A435.64.1
artic. end scapula 1964 misc.

1 ~~Phalacrocorax~~ ? Sula?
Prox end ulna

6 Mancallidae
2 prox. ends carpometacarpus
1 dist " humerus
1 upper half coracoid
1 artic end scapula
1 frag tarsus

14(+3?) Alcidae
OK 1 complete small ulna } short for girth
OK 1 dist half " "
~~1 prox half large " not alcid tiny Sula or Puffinus~~
1 2 " end, between sizes (2 may be Puffinus, or ?
OK 1 " carpometacarpus
1 dist " " tiny (in bottle)
3 " half coracoid
2 ~~inc~~, tiny "
1 vert. (~~thoracic~~) misc 1964
1 dist frag tarsus (ident?)
1 inc, humerus
1 shaft tarsus size of Uria (may be Mancalla)
1 upper shaft " " " " " (Longmaltus)

see next sheet 4.12.65 gives total 17

43 Puffinus
Prox ~~[illegible]~~ tip ulna } same size (Opis No.)
Dist. ½ ulna

Prox end carpometa (Fulmarus?)

3 distal ends (inc) humerii
1 " " humerus (1965)
1 prox tip humerus (try Fulmarus
2 shaft humerus 1965 + Aug 1964
1 frag prox shaft "
1 prox end ulna
1 " part shaft " (try Fulmarus)
7 dist ends ulna
1 " " " (Langenwalter)
4 upper part coracoids
1 prox end carpus
1 dist " "
5 prox half tarsus (2 sizes?)
2 prox " " 1965 (" " (1 "various, 1 with pubis")
2 dist " " ~~1964~~ (" "
1 " " " 1965
4 shaft "
2 wing phalanges (2 sizes?)
2 scap. (dist) 1964
1 " (") 1965
2 tibiotarsus dist. (Dec + Aug 1964)
1 dist part dr tarsus (Aug 1964)

Birds?

~~50~~ 1 + stone to be checked
45 sp.? (check 1964 misc tray further, only a few (others here))
Tiny prox end ulna (8.15.64)
3 small pedal phals.
1 med. " "
1 large " " (dist.)
7 shaft frags.
~~1 dist end radius~~ ? 1965 ~~(Calhoun)~~ Try ~~Sula or~~ goose? ~~(1 Calhoun, 1 "various")~~ 9/6/5
1 dist frag ~~femur~~ (tiny, 49, eroded) (Langenwalter)
2 frags large scap (various) 1965
1 dist frag (mid troch) tarsus large ("various, 1965")
1 " end tibia " "
~~1 prox end radius large~~ try Sula — try vulture 1964 misc
1 dist end radius. med.
25 phals. (a few wing, other pedal)
~~1 large scap, 1964 try flamingo (no [illegible] goose)~~
1 up sh tarsus large 1964

painting by Peterson
3.5' bill to total

from Nat Geog. May
lower jaw to tip bill 43 — 86% of length — 62% painting
36% of length/bill — 50%
length 215
tip to bridge 120 — 56% of length — 43.5%
eye to [illegible] 70 — 33.5% " — 50%

24 : 19
120 : 95

El Toro Total 84

Unidentified fragments

Dec. 1964

54 Phalanges 32 pedal, 7 wing
Verts, 4
tarsal frag, 2
carpometa dist 5
humerus frag 2 (1 gray, 1 brown mammalia?
femur frag 3 tiny
tibia 1 tiny prox, 1 med, 1 cond (sulcid?
radius 1 tiny prox

1 8.20.64 – shaft of tiny humerus stratum B (brown)

1964 (month?)
radius dist end – well preserved small goose?
16 scapula 1 shearwater? well preserved, 1 large very poor preservation
fibula 1
tibia 1 prox frag, med., 1 dist frag no bridge, large;
radius 1 tiny prox frag
tarsus 2 water worn frags, 1 int troch (not worn), 2 mid troch
ulna 2 dist frags small, 1 dist frag, large,
carpus 2 poorly preserved prox, (one quite small worn + hard matrix

Date?,
Rec 1945 from Ed Wiedert
1 waterworn femur dist
(hard matrix)
Sulidae

1.18.65
Pedal phalanx 1
wing " 2
~~Tibia~~ 1 shaft, ~~1 shaft + [illegible]~~
~~humerus~~ ~~1 shaft (ident?)~~
9 tarso. 1 outer troch (large
radius 1 prox
~~tarsus~~ ~~1 frag (ident?~~
Vert 1 centrum
ulna 2 shafts
Mammal? 1

1.17.65
femur – tiny dist
ulna dist

2

Unnumbered.

Sacrum Sulidae? worn
scapula Fulmar?,
type 7, hoppmeri carpus
ref, " " humerus
phalanx Diomedea large
radius prox - large Sulidae
~~6~~ frag Puffinus ~~[illegible]~~ 1964
7 " " 1965
1 frag femur Sulidae worn

Alcid tarsus (2?)
23 ulna 5
carpus
coracoids 4
Cepphus humerus
humerus frag.
quadrate
femur (? ident)
5 small

Praemancalla
Other than type not worn
Coracoid 15289
carpus 15287 & 15290 (frag)
scap 15294
mand. 15428

#1 Puffinus 42 (1 humerus, water worn)
+ 17
59

El Toro
5,2364

Loc 1945

Fossils of smooth dark brown

1 Type of Praemancalla - humerus

2 Osteodontornis jaw

3,4,5 3 bones "Presbychen?"

6,7,8 Large sulid - 17566 carpo, 17569 coracoid, 17565 tarsus (with matrix)

9,10,11,12 4 other large sulid bones 17577 quadrates, 17564 , radius 17568 17579 carpometacarpus

13 ~~[illegible]~~ Small sulid - ~~17556 humerus~~, 17554 tarsus, 17555 ~~carpo~~

[From 65120 - 2 large sulid with matrix]

Lighter brown - not as smooth

Praemancalla - 2 carpo, coracoid, mandible

Large sulid - tibia

Most shearwaters

small alcids

Diomedea? tarsus

Mottled like San Diego

Cerorhinca humerus

Phalacrocorax ulna

Tarsus Puffinus

Fulmar - 2 bones

Loc 1945

Diomedea sp. 17550 ✓ Tarsus

Diomedia californica? Miller 18271 ✓ pedal phalanx 4

Puffinus calhouni Howard n. sp.

Type right humerus 17508 ✓
left " 17539 ✓
right ulna 17530 ✓
left tarsus 17582 ✓

Tentatively assigned
dist. humerus 17540 ✓
2 shaft tarsi 17524 ✓

Puffinus priscus Miller?
Dist. humerus 17548 ✓
ulnar shaft 17547 ✓
prox. tarsus 17538 ✓

Puffinus sp.
Prox. tarsus 17549 ✓
Dist. " 17543 ✓

Puffinus calhouni or *P. priscus*
4 coracoids 17528 ✓, 17529 ✓, 17531 ✓, 17534 ✓
dist. femur 17516 ✓ and 38 other bones

Fulmarus hammeri Howard, n. sp.
Type prox. end left carpometacarpus 18262 ✓
Ref'd frag. dist end humerus 18263 ✓

Osteodontornis orri Howard?
fragment lower mandible 17557 ✓

Microsula, sp.

Dist. humerus 17556 ✓
" carpometacarpus 17555 ✓
Prox. tarsometatarsus 17554 ✓

Morus lompocanus Miller ?

Dist. tibiotarsus 17570 ✓
Two prox radii 17574 ✓ and 18268 ✓

Miosula ? sp.

~~Head~~ upper end of coracoid 17569 ✓
prox, carpometacarpus 17566 ✓ (another carpometacarpus 17599 ✓)
dist. radius 17568 ✓
prox tarsometatarsus 17565 ✓
dist. femur ?

Sulidae, sp

2 dist. radii 18264 ✓, 17572 ✓
cuneiform 17562 ✓
scapular frag. 17560 ✓
mid troch. tarsus 17575 ✓
3 dist. carpi 17558 ✓, 17561 ✓, 17578 ✓

Presbychen abavus Wetmore

Prox. frag tarsus 17552 ✓
prox femur 17553 ✓
Scapula 17551 ✓

Anserinae, sp. dist. radius 18270 ✓

Alca sp
Frag. coracoid 18282 ✓
Inc. humerus 18283 ✓

Cerorhinca sp
Prox. ulna 18274 ✓
Dist humerus 18275 ✓

Aethia rossmoori Howard, n. sp.
Type complete right ulna – 18948
Ref. left humerus (dist.) – 18949
Tentatively referred
Dist. ulna 18960
" carpometacarpus 18951
3 frag. coracoids 18952 and 18954 (2 bones)
prox radius 18953

Alcidae, spp
2 coracoids 18274 ✓
prox ~~[illegible]~~ frag ulna 18272 ✓
2 tarsal frag. 18273 ✓, 18281 ✓

Alcodes ulnulus Howard, n. sp
Type Complete left ulna 18277
Ref. Dist. right ulna 18279
& Prox right carpometacarpus 18278 ✓
Tentatively referred
Prox right ulnar frag. 18280 ✓

Praemancalla lagunensis Howard (described 1966)
Type ~~Humerus~~ 15288
coracoid 15289
2 carpometacarpi 15287 (paratype) and 15290
scapula 15294
frag. lower mandible 15428

Final identification of specimens from Locality 1945 (avian)

carpometa.
15287 ,15288, coracoid 15289 and 15290 and 15428 mandible   Praemancalla lagunensis
15288 humerus type, 15287 paratype   15294 scapula

17508 type humerus of Puffinus calhouni Howard, n. sp.
17516 femur ~~xxf~~ either Puffinus calhouni or P. priscus
17528, 17529, coracoids either " " " "
17530 ulna, Puffinus calhouni
17531 coracoid, either P. calhouni or P. priscus
17524 Two shafts tarsometatarsi, P. calhouni?
17543 dist. tarsometatarsus, Puffinus sp.
17534 coracoid P. calhouni or P. priscus
17539 left dist. end humerus Puffinus calhouni
17540 dist. end humerus tentatively referred P. calhouni(?)
17538 proximal end tarsometatarsus,Puffinus priscus Miller?
17547 shaft of ulna, Puffinus priscus Miller?
17548 distal end of humerus, P. priscus Miller?
17549, proximal tarsometatarsus, Puffinus sp.
17550, Diomedea sp
17551, 17552, 17553, Presbychen abavus Wetmore
17554, 17555, 17556, Microsula sp.
17557, Osteodontornis orri Howard?
17558, distal end carpometacarpus, Suildae, sp.
17560, frag. scapula Sulidae, sp.
17561, distal end carpometac rpus, Sulidae, sp.
17562, cuneiform, Sulidae, sp.
17565, proximal end tarsometatarsus, Miosula? sp.
17566 proximal end carpometacarpus Miosula?sp.
17568 distal end radius Miosula? sp
17569 upper end coracoid, Miosula? sp.
17570 distal end tibiotarsus Morus lompocanus Miller?
17572 distal end radius, Sulidae, sp.
17574, proximal end radius Morus lompocanus Miller?
17575 middle trochlea tarsometatarsus, Sulidae, sp.
17578 distal end carpometcarpus Sulidae, sp.
17579 proximal end carpometacarpus Miosula? sp.
17582 left tarsometatarsus, Puffinus calhouni Howard
18262, 18263, Fulmarus hammeri Howard, n. sp. (type is 18262)

18264 distal end radius, Sulidae, sp.
18268 proximal end radius, Morus lompocanus Miller?
18270 distal end radius, Anserinae, sp.
18271 pedal phalanx Diomedea sp.
18272, proximal end ulna, Alcidae, sp.
18273, tarsal fragment Alcidae, sp.
18274, proximal end ulna, Cerorhinca sp.
18275 distal end humerus, Cerorhinca sp.
18276 2 coracoids, Alcidae, sp.
18277
18278 proximal end carpometacarpus Alcodes ulnulus Howard, n. sp.
18279
18280 proximal fragment ulna, Alcodes ulnulus Howard ?
18281 fragment tarsometatarsus, Alcidae, sp.
18282, fragment of coracoid, Alca sp.
18283, incomplete humerus , Alca sp.

Cygnus = old world mute swan
Olor = whistling
Chars of tarsus of Presbychen * = both specimens

Differing from Branta and swans in *① greater depression anteriorly in region of prox. foramina and ② less extension of the prox. cotylae internally; *③ external border of shaft anteriorly very distinctly marked, in a straight line ventrally from ~~[illegible]~~ ant. edge of ext. cotyla ~~, rounding~~; Ext. side *④ at level of attach of tib. ant. muscl. *⑤ of shaft rounded laterally and deep antero-post. as in swans (ant.-post. depth narrower prox. in Branta); ~~internal side~~ ⑥ outer surface of ext. calc. ridge (this area depressed above foramen as in Cygnus olor (this area ~~very~~ flat in Branta & Olor); *⑦ Int. border of ant. face of shaft ~~becoming~~ a well marked ridge for only a short distance below prox. end, ~~[illegible]~~ becoming indistinct toward middle of attach of ~~tib~~ ant. muscle (closest to Cygnus olor in this char.)

chars. 1, 3, 4, 5, ⑦ in both specimens (El Toro & Sharktooth)
⑤ ⑥, ⑦

Ratio br. prox. tarsus to br. dist. tibia C. columbianus

106.7
103.8
103.9 %
102.2
4)416.6
104.1

Ratio of 104% tarsus for 18.6 mm tib of fossil
= 19.3

Ratio 104% tarsus/tibia for 18.2 mm tarsus of fossil = 17.5

~~fossil~~ Ratio max to min. range tib = 96.5 or tib 3½ % larger than max ~~[illegible]~~ min
tars. = 96.2 " " 4% " " "
" " " " " " " 17% " "
" tib –
C col. " " " " tars –
" " " 1½%" " " min

range?
max min
18.6 – 17.5 tib 106%
18.3 – 18.2 tarsus 106%

① less ~~lateral~~ internal flare of proximal ~~articular cot~~ ~~internal cotyle~~ cotylar area

② ant. face of shaft deeply depressed in reg. of prox. foramina

③ ext. border of tr. straight

	Swan columbianus #918	#1439	Presbychen Type	Presbychen ref'd	Branta can. int.	El Toro form	Eremochen
br. dist. end tibiotarsus	22,1	—	18,6	—	16,0	—	—
br. prox end tarsometa.	23.5 (19.8 inside cotylae)	—	—	18.3	—	16,2	—
br. prox end scapula	17,0	15.8	—	—	13.3	13,0	12,1
depth int. shaft of tarsometa.	8,7	—	—	9,0	—	—	—
depth trochanter femur	18,5	18,4	—	—	—	16,6	—

An anserine scapula (17551) lacks large pneumatic foramen characteristic of geese and, except for 30% smaller size closely resembles mute swan *C. olor*. In view of the similarities to C. olor noted in the tarsometa. of Presbychen (over sheet) from Sharktooth Hill, it is possible that this swanlike scapula also represents Presbychen. The specimen differs from Eremochen (which also lacks the pneumatic foramen) in the large, knoblike coracoidal tuberosity.

goose vs swan

Scapula El Toro

Mex ← Eremochen	Ore		El Toro	Swan 1456	918	Branta can. 1844	1094	1845	18231
16.4	18.7+	Br. from tip acromion to glenoid facet	17.8	28.0	24	—	21.2	20.1	—
7.9	8.4	Length glenoid facet	8.6?	13.3	11.3	14.6	13.1	11.9	8.6
12.4	12	Acromion to coracoidal tub.	13.8	17.1	15.5	17.4	16.9	14.2	13.7
x 11.7	12.0	Br. below acromion to glenoid facet	12.4	18.5	16.9	15.1	14.1	14.1	13.2
y 8.0	8.6	Br. shaft below glenoid facet	9.1	11.7	10.9	10.0	9.3	9.0	8.3
57.5%	50	← ~~zy ratio~~	57.1	47.9	57.0	56	60.3	60%	
z 4.6	4.3	Depth shaft same place	5.2	5.6	6.2	5.6	5.6	5.4	5.4
5.3 × 3.2 =60%	65% 5.0 × 3.4	Coracoidal tub.	transverse dorsoventr. 90% 6.3 × 5.7	91% 5.9 × 5.4	97% 6.4 × 6.2	70.5% 6.8 × 4.8	69% 6.2 × 4.3	79% 5.8 × 4.4 6 × 4 67%	
68.4	71.4	Ratio y/x	73.3	63.2	64.5	66.2	66.0	64.0	

Characters of the scapula from El Toro

① Swanlike in absence of dorsal foramen back of coracoidal tuberosity. Resembles Eremochen

② Coracoidal tuberosity very prominent, more set apart from glenoid facet than in both swans and geese or Eremochen.

③ Proximal edge of glenoid facet seemingly more Branta like (rounded off, not projecting in a point as in swans)

The size seems too small for Presbychen abavus, as it is actually ~~smaller even than~~ the same as Branta canadensis, cit. #18231 except shaft heavier

The type tibiotarsus of Presbychen abavus is 83% of ~~large~~ smaller swan, 76% large swan, 111.2% of B. can. cit. #18231

595
12) 6900
60
90
8460

865
12) 10380
96
78
72
60

1450
12) 17500
12
55
48
70

Femur

Femur
Presbychen?

	El Toro	Shuckbaatt	Swan O. columbianus 1746	C. olor 918	B. canint 18231	B. can. can. 1094
Br. sh	11.2	—	14.8	13.4	10.5	11.4
Depth sh	8.9	8.6?,	10.9	9.2	7.8	8.4
Depth troc.	16.6 min	15.3+	21.8	18.8	16.+	18.4
Base of head	9.2	8.6	10.8	9.5	7.7	9.6
Ht head	9.3?,	8.9?,	10.2	9.4	7.4	8.9
ant.-post. diam. head	10.9	11.3	12.8	11.2	8.7	11.2
Length trochanter lower muscl scar to high point on articulation	26.4	24.0	29.5	27.7	20.4	23.4

Hard to compare due to erosion, but SIZE of FOSSILS OK for Presbychen abavus but rel. less than typ. tibia

Characters:
① Most ext. projection of trochanter seems to be more centered bet. ant. & post. face than in Branta or Cygnus
② Head more prominent, more raised above articular surface, more ~~[illegible]~~ depressed at base
③ Ant. tip of trochanter seems less extended around onto ant. surface, but this may be due to wear. Thus trochanter less deep than geese,

Tarsus

	El Toro	Shuckbaatt	Swans 1746	918	B.c. int 18231	B. can. can 1094
Br. Prox	—	18.3	25.3	23.5	17.4	
Br. sh	11.1	10.2	12.8	12.0	7.9	8.1
Br. ~~dist~~ threw inter cotyl. tub.	13.4	13.0	17.2	16.6	12.1	—
dist. tip of muscle scars to tip proxend	19.9	20.7	27.4	24.1	20.4	20.7
Dist foramina to tip prox end	11.3	11.1	14.8	14.8	10.8	10.7

Characters ① int side hypotarsus, foramen higher (more prox.) than geese or swans & area slightly depressed (flat in rec. forms, tho C. olor is depressed above the foramen
② Ant. shaft more depressed below intercotylar tub espec in El Toro specimen. More goose like than swan like
③ Muscle ridges rel. closer to prox-end than in geese
④ Ext ridge of shaft very deep ant-post'ly (just the ext side, not on centr'g post. surface — not like 1746, in others post edge [illegible] recedes [illegible] below [illegible]

Size OK Presbychen abavus

El Toro (Laguna Hills) sulid (s?) Small sp.

Humerus (distal) br. distend 15.2 = ~~Sula~~ (possibly willetti?)

17556

Palaeosula much larger		
Sula stocktoni	17.3	San Fernando Valley Mid.
Sula humeralis	19.8	San Diego, Pliocene
Morus vagabundus	18.3 (type), 18.4 later find	both Sharktooth Hill
Sula willetti	? (small)	
Miosula media	19-20?	
Morus lompocanus	30.4	
Sula avita (Marsh)	14.9	

Rec. leuco extremes br dist 16.6 – 19.4

c ant br head
b ~~middle~~ semimtr head
a top of glenoid to head
78.5 17.3 x 24.5, morus 17.2
63.1 12.8 20.8 S. dact. 13.8
60.7 13.3 x 21.0 fossil 14.7

Even the size range could include vagabundus
The El Toro humerus is clearly Sula in more enclosed olecranon fossa, & in broader scar (palmar side)

17569

Coracoid (upper end) ~~not like Morus~~ Large sp

			M. bass.	S dact.
at glenoid fa. br.	16.6	across triosseal canal	19.4	17.0
" middle "	15.2		17.0	14.5
depth sh	6.7 min.		7.8	6.9
lat glenoid	14.5		14.8	13.0
depth "	8.7		10.7	8.4

Broken through brachial tuberosity
Like Morus in neck being less deep cut &
less sharply contoured ~~[illegible]~~ anteroexternally
but like Sula in ~~[illegible]~~ shortness of
this anteroext. contour & shorter head area

	smaller El Toro 17554	large Sharktooth Hill	small SH	large El Toro 17565	willetti type	extremes S. leucogaster
Tarsus (prox tip) br.	12.1	13.7	12.6	13.3	12.2	11.9 – 13.6
int calcan. tip	6.85	6.9	6.0	8.5		7.0 – 9.0
depth through int cotyla & calcan	10.2	13.5	12.0	12?		10.4 – 12.0
btw.	8.5	9.4	—	9.5		2.9 9.0

Has bell-like intercotylar eminence as in Sula (Morus is broad & low)
but ext. cotylar margin rises posteriorly smoothly, seemingly is without
The unevenness of contour char. of Sula (hence like Morus)
This is true, also of the larger tarsus (br 13.3, depth 12 min, int calc tip 8.5)
br sh ~~[illegible]~~ 9.5

			Rec. bassanus	Rec. dact.
Tibiotarsus (dist.)	br. ant'ly	13.3	12.9	14.0
	depth int cond	13.0	12.1	13.0
depth both sides	" ext. "	11.0	10.4	9.9
		12.5	12.0	11.6

17570

Relatively narrower & deeper than in Sula
Bridge also like Morus (or more so) in distal end more laterally (ext) placed
& less vertical than in Sula dactylatra. Lacks papilla
above ~~ext~~ condyle char of Sula, rough swelling as in Morus
less [illegible] post part of int condyle & more grad margin of articulation
onto shaft post'ly than in Sula (more like Morus)

17564 Carpometacarpus (prox) like Morus in ant carpal fossa unexcavated
+ no foramen. Consid. variation among Rec. forms of Sula
+ fossil fully hard matrix. In gen. less pneumatic

		bassan	dactylat
ext depth thru M1	16.7	18.6	17.6
int depth thru M1	17.8	20.1	18.8
br troch	8.2	9.8	8.8
ht M1 (int)	12.5	12.4	12.5

M1 set high, process nearer to prox tip of troch + facet for digit 1 abortion level of distal terminus of int. ~~[illegible]~~ crest of trochlea; In Rec Sula + Morus this facet is notably below level of int trochlea crest

Suggestion is that two sps exist
Small one could be willetti (too small for vagabundus

Other fossil Sulids
M~~orus~~ reyanus Pleisto Calif, coracoid
Morus peninsularis Brodkorb (Fla Plio)
Coracoid (smaller than M. bassanus ~~about~~
M lompocanus + M stocktoni
larger than M. loxostyla + M. vagabundus

fossil Sulids (in order of presumed size – largest first
large Palaeosula stocktoni up Mio Calif. (Plio?) larger than M. bassanus
Morus lompocanus up Mio, Calif. slightly below M. bassanus
Morus reyanus Pleisto Calif. slightly below M. bassanus
Morus peninsularis mid Plio, Fla slightly below M. bassanus
Morus vagabundus up Mio Calif
Morus loxostylus low Mio (eastern)

---

large Sula ronzoni low oligo) larger than M. bassanus
" " arvernensis up Oligo)
" phosphata) nearly same size; less than bassanus
" guano
" willetti
larger than "guano" " pohli
" avita low Mio Maryland (small)
" pygmaea mid Mio France

1 small
probably 2 large

EL TORO
Sulidae

Microsula? (defined by lack of pneumatic foramina
Type M. avita dist. end humerus, Maryland)

17556 Jan 1965
EL TORO Distal end humerus 15.3 (smallest leucogaster brewsteri 16.6
(type M. avita, 15.2)

in sep. tray
Jan 1964 Shaft humerus? br. 9.1 depth 5.13 (leuco, 8.2 × 6.6) lat. dorsilinia = Sula

Jan 1965 Two distal ends carpometacarpus, depth 9.0 (br. ant. 6.4 & 6.5)
[from Ellus avita? 9.8? 6.5?]

one Microsula
17555

Jan 1965
17554 One proximal end tarsometatarsus, br. 12.0 (leuco, 11.9)

1964 (no month given) Small fragment of scapula?

* = matrix encrusted
or waterworn
or worn

Sula?, ~~Morus~~, sp. 1

* Prox. end carpometacarpus with slender M1 as in Sula
depth thru M1 17.6, br troch 8.3 (smaller than
either dactylatra 18.8 × 8.9 or M. bassanus 20.1 × 9.8)
but closest to dactylatra (matrix encrusted)

* One may be larger = Morus sp. 2 it is matrix encrusted

Three distal end carpometacarpus closest to dactylatra in
size but with narrower symphysis, more like Morus

One prox end radius? 1.18.65 – gray matrix as in tarsal frag & scap.
size = dactylatra & bassanus

Distal end tibiotarsus size = dactylatra & Morus
gr. depth than br., narrower sulcus than Sula
One distal ~~frag~~ tarsometatarsus, size = dactyl. & bassanus
gray color looks more recent than others 1.18.65 genus Morus

* One coracoid size = dactylatra, chars. Morus?
bicipital attach. more piblike than in Morus, closer to Sula
great breadth through scap facet like Morus
less overhang of head as in Morus (matrix encrusted)
One scapula = large (preservation as in tarsal frag) 1.18.65
gray

Morus, sp. 2

* Prox end tarsometa (matrix encrusted) sh. br. greater than bassanus but deeper than Sula
* Dist " " (" ") larger than bassanus
shaft broader
loc 65120

* Quadrate

* Distal end ulna carpal tuberosity pneumatic ext'ly) as in Morus but no pneumatic foramen adjacent to ext condyle, thus dif than either Sula or Morus size
nearer dactylatha

Sula sp 3

OL D but see last ¶

Radius, dist end no. 17568, has a large pneumatic foramen in a long longitud depression as in Sula. ~~[illegible]~~ ~~placement is a~~ but the placement of depression + foramen is nearly centered with respect to the ext + int borders of the shaft. ~~[illegible]~~ In all species of even Sula compared the depression + foramen are ~~more~~ nearer the ~~[illegible] border~~ ligamentar prominence

~~In~~ In dist end This radius ~~is slightly larger than the~~ falls between ~~max~~ S. leuco. + S. dact but depth through the lig. prominence is greater than either. Although its size is not markedly greater than ~~the~~ in 175532 discussed above, the presence of the large foramen immediately distinguishes it.

sp 3

Sula sp. B

Coracoid, incomplete 17569, is ~~a~~ larger than this element in S. dactylatra but very much smaller than in M. bassanus. It is further distinguished from the latter form in less prominently projecting area of scapular facet; ~~it~~ flatter surface of triosseal canal; more depressed ~~depressed~~ lig. attach. on ~~ventral~~ ~~(int.)~~ ~~side of~~ antero-int. ~~medial (int.)~~ side of head situated ~~[illegible]~~ ~~anterior, depression~~ (lower than in Morus). In all of these ~~glenoid facet~~ characters similarity is closer to Sula.

Sula sp 5

[illegible]?

Humerus, distal end no. 17556 resembles this element in Sula in the narrow, deep ~~[illegible]~~ olecranal fossa, with small foramen inside the lateral border; the muscle scar above the ectepicondyle also ~~turns~~ onto the palmar surface at a ~~a~~ more acute angle than in Morus + blunt tip of ext condyle. The specimen also bears ~~certain~~ similarity to Miosula in the greater near absence of the pneumatic foramen ~~and~~ + shallow brachial impression are slight development of the ectepicondylar process and a relatively broad, short surface of the ant. art. lig. as well as a globular int. condyle.

A fragment of humeral shaft (LACM 17567) may belong to this same small species. The line of the latissimus dorsi anterioris muscle is centered on the ext. side of the shaft as in Sula as con~~trasted~~ with the Morus, but the attach of the lat. dorsi post. is closer to the edge of the deltoid crest & the crest itself is less prominent. Proportions ~~of the shaft~~ indicate a ~~flatter~~ but broader shaft than in *Sula leucogaster* (br. 8.3 × depth 5.2; S. leuco. 7.2 × 6.2 85%)
62%

El Toro Sulidae

(Another large one probably also Morus but smaller than tarsus El Toro
Small one size ok for Microsula avita
Large one with encrusting matrix (prox in 1945, dist in 65121)
tarsus is probably Morus)

Prox end carpometacarpus
L { Br. trochlea 8.3 (1356 dactylatra 8.9, 1349 leucogaster 6.8 min.) 18173 Morus → 9.8 nebouxii 6.8
depth prox 17.4 — " 18.8 — 14.2 → 20.1 14.1
% 47.2% 47.3% 47.9% 48.9% 48.2%

Process of M I, rel. slender (Morus heavier), (less heavy at base)

Dist end carpometacarpus L L? 1356 dactylatra 1349 leucogaster 18173 M. bassanus 253 nebouxii 6051 avita
2S gr. depth 9.0 (S) 9.0 (S) — (L?) 10.2 9.8? 11.3 9.0 12.3 9.0 9.8?
2L br. 6.4 6.5 7.7 7.4 7.0? 7.9 5.5 8.5 5.5 6.5?
S S L L

+ Tibiotarsus dist. (L)		dactyl	leuco	bassanus ✓	nebouxii
Br. (ant.)	13.35	13.9	10.0	13.3	11.0
depth ext	11.2	10.0	7.15	10.4	8.5
depth int	13.4	13.2	9.0	12.0	10.6
let. int	8.4	8.1	5.9	8.3	7.2

Tarsus prox

S - Br. prox 12.0 (1356 dactylatra 15.2 br sh 10.2 67%, 1349 leucogaster 11.9 br sh 7.1 59.5%, 18173 Morus 14.4 br sh 8.6 59.7%)
12.0 nebouxii

~~Morus~~ L ~~cotylae~~ 13.9 (br sh 9.8) (70%) (this one has long gradually sloping int calc. ridge)

Tarsus dist (mid troch)

2L	no. 1945	dactyl.	1349 (min) leucogas.	M. bassanus	253 nebouxii	El Toro no. 65121
br. (ant.)	5.6	5.3	4.0	5.8	4.5	6.7 (br. dist 17.1)
depth	8.0	7.4	5.7	8.3	6.3	8.5
%	70.0%	71.7%	70.3%	69.4%	71.4%	78.7%

9.8 × 5.6 br depth shaft

Humerus (dist.)		1356 dactylatra	1349 leucogaster	18173 M. bassanus	253 nebouxii	Microsula	M. vagabundus Type	M. lompocanus
S Dist. Br.	15.3	21.1	16.6	24.0	19.0	15.2	18.3	21.1
condyles { depth ext	9.2	12.5	9.7	14.2	11.3			
" int	5.65	8.0	5.65	8.7	6.9			

Shark Tooth Hill specimens 17.2 and 18.3 unrecorded.
S. humeralis San Diego 19.8

Humerus shaft (S)		1356 dactylatra	1349 leucogaster	18173 M. bassanus	253 nebouxii
Br. just dist to deltoid	9.1	11.3	8.2	14.8	9.0
Depth same place	5.3	9.6	6.6	9.9	7.0

Insert. lat. dorsi ant. close to deltoid as in Sula (possibly even closer than in living forms). Shaft flattened (nearer Morus than Sula in this)

Coracoid (L)		dactyl ✓	leuco	bassanus	nebouxii
Br. at scap. facet	16.6	16.1	11.8	19.6	13.6
Br. thru glenoid	15.1	14.2	10.5	17.8	11.7
Ht to head from end or scap facet	23.4	22.5	16.7	26.5	19.2

size? Radius dist. (large foramen but ext to position of foramen in Sula, shape of the lip as in Sula
Br. 10.5 dactylatra 11.6 leucogas. 8.7 bassanus 12.7 nebouxii 10.6

L Scapula br. sh 6.3 " 6.8 " 4.8 " 7.5 " 6.0
depth sh 3.9 " 3.8 " 2.6 " 4.2 " 2.9

S? Also an unmeasurable smaller scap.

El Toro

Ulna (dist.)	*35121	dactyl.	M. bassanus	1349 l. brewst.	1339 websteri	253 nebouxi	251 brewsteri
gr. ~~depth~~ br.	14.4 inc	13.2	17.1	10.1	12.1	12.0	11.7
ext depth	10.8?	11.1	12.9	8.5	10.6	10.1	9.8
br. sh.	8.9	8.6	9.5	6.1	7.4	7.7	6.75
depth sh	6.8	7.7	7.7	5.2	6.3	6.4	6.0

(less depth than any Rec. forms, but Morus is closest)

Sacrum large no # water worn

Sulidae El Toro "

*A Radius ✓ distal rt 17568 water worn (hard matrix adheres) Miosula? sp. ✓ —

*A Carpometacarpus ✓ prox left 17566 ✓ Miosula? sp.

*B Coracoid ✓ " rt. 17569 water worn & hard matrix adheres ✓ Miosula? sp. —

*A Tarsometatarsus ✓ " 17565 " " " " ✓ Miosula? sp.

A✓ or E? ~~Quadrate ✓~~ 17577 " " " ✓ } Miosula? sp.

~~Quadrate frag small~~ ✓ 17564 " " " ✓ —

*A Carpometacarpus ✓ w/o dist 1/2 rt 17579 " " " " " ✓ Miosula? sp. —

A A A " 3 " " left 17558 17561 17578 } — Sulidae, sp. not water worn

*E Radius dist right 17572 O Sulidae, sp.

— ~~Humerus~~ sh frag X rt 17567 X

*size? Scapula frag artic rt 17560 O Sulidae, sp.

*E Tarsometa. prox X ? rt 17554 water worn (hard matrix?) Microsula sp X

*C ~~Humerus~~ dist X rt 17556 not water worn X Microsula sp
a bit smaller than 1349

*E Carpometa " 1/2 rt 17555 not water worn X? Microsula sp.
(size = Bi1349)

— Pedal phalanx 17571 " " "

*D Tibiotarsus dist left 17570 ⊗ M. lompocana?

B Radius prox 17574 ⊗ M. lompocana?

B? Tarsometa dist frag mid rect left 17575 Sulidae, sp.

St. Scapula abraded rt 17576

" frag artic left 17559

*A Cuneiform O 17562 O Sulidae, sp.

Ulna prox rt rough 17563

In order of size large to small 1 * unident. 6

✓D Larger than bassanus 1 1 ~~Tibia Morus~~

B Equal to dactylatra 3 1. Coracoid Sula

A Bet dactylatra & nebouxi larger than leuco. 10 5 Rad Sula, carpus Morus?? tarsus, cuneiform Morus

E Equal leucogaster 3 3 Rad Morus, carpus, tarsus

C Smaller than " 1 1 humerus.

A 9 specimens

Morus (?) size between nebouxi & dactylatra

✓17566 Prox end carpometacarpus (hard matrix adheres)

✓17579 Dist " " (" " " ? no diag. chars

17560 Frag scapula (brown) ~~size to be checked~~

✓175~~68~~ Dist radius (" with matrix hard

✓✓✓ 17558, 17561, 17578 3 dist carpi no chars.

✓ 17565 Prox ~~tarso~~ carpometa hard matrix

✓ A Morus? Size ~~equal to~~ larger than dactylatra but less than bassanus B

↓ 2 specimens

17562 Cuneiform (gray)

✓ 17574 Radius (prox) " size to be meas. chars more Morus?

?✓ 17569 Coracoid - size a bit larger than dactyl. chars. more Sula

Sp. E 3 specimens

Genus? size bet leucogaster (min.) & nebouxi (within leuco) to less depth qr.

~~Sp E?~~ ~~17868~~ ~~Dist radius with large pneumatic foramen~~

✓17555 Dist carpus no chars.

✓ 17572 Dist radius

~~equal to~~ Sp. C 1 spec.

Microsula? size less than leucogaster

17556 Dist humerus size less " "

✓ 17554 Prox tarsus " equal larger leucogaster & nebouxi

Sp E

Morus - very large Sp D 1 specimen

✓ 17570 Tibiotarsus dist. greater than M. bassanus. ~~Chief~~

~~[illegible] is the very great prox extent of the [illegible] and track as seen posteriorly, coming to a clean point at equal with the shaft, compact compact shaft~~

Miosula (?) sp. ✓ ⑦ 8

Seven water worn fragments + tibia?

?, Microsula, n. sp. × ~~3~~ 4

Humerus 17556 and tarsus 17554 6
and humeral frag. 17547, carpus?

Morus. sp. A ○ ~~4~~ 5

Cuneiform 17562, scapula 17560, radius 17572

~~Morus (?) sp. 3~~ (X) 3

metatarsal trochlea 17575 Tibiotarsus 17570 and radius (prox.) 17544

Sulidae sps. (6)

= Microsula?
Carpometacarpi (dist.) 17558, 17561, 17578, ~~17555~~

pedal phalanx, 17571, ~~tarsal troch 17575~~, 2 scaps. 17576
17559

[ulna 17563]

April 1966

Sulidae

62 8
53.8
21 6 6

femur + humerus length = bassanus tarsus & tibia longer

	Shark tooth			El Toro					Kern River pt.	San Leonardo Valley unrecorded larger species? 2 sides br. prox 29.2?
Br. dist humerus	vagabundus 17.2	vagabundus 18.3		15.3			[lompocanus?, + bassanus]			22.1
Length "	—	17(?)		—						216+?
Length cora.	—	—		—	—					65+
br head "	—	—		—	—					
Gr. br. "	—	—			16.6 } smaller than M. peninsularis but larger than dactylatra agee					
Lat upper "	—	—			23.4					23.3 shorter than Bassanus lompocanus?
Depth prox carpus					17.6 } smaller than dactylatra					
Br trochlea "					8.3					
gr. Depth dist "				(2) 9.0 —		10.2	9.8	—		
Br dist "				6.4 6.5 averages		7.4	7.6	7.7		
Br. prox tarsus	vagabundus 12.7	sp.? 13.7		12.0	—	13.3 less than dactyl.				12.5?, 13?,
Br. dist "					17.1 } larger than dactylatra					16.8
Br mid " ~~trochl~~			5.6		6.7			5.7	depth 8.2 br 4.8	66.1 length
Ext prox ulna	14.+	larger on rec'd by Miller								
Int prox ulna 2 adult sample sig	12.3									
Br. prox ulna	13.7									
Gr. br. dist tibia					14.4 larger than dacty. ~~bassanus~~					
Ext depth dist ulna					11.1 inc					
Br dist tibia					13.5 = dact + bassanus					
depth ant. tibia dist					11.2					
Br. int. "					13.4					

El Toro [illegible]

	El Toro							ulna							Sula leucogaster brewsteri					
	Tarso 17554 ~~sula~~ sp E? ✓	sp A ✓ Tars 17565 Morus ?	dist Tarso 65120 17580 Dor B?	micrurula Humerus 17556 sp C	coracoid 17569 sp B	~~carpus~~ 17566 sp, A	tibia 17570 sp D	dist ulna 65120 17581	m bass.	1356 dact. ulnae	1352 S. l. brewsteri mex	Mike Bell S. willetti		Sula sula web. 1339	1349	251	1352	S dactylatra 1356	Morus bass. ~~1423~~ 18173	1783 253 S. nebouxii
Br. prox cotyla	12.1	13.3+	—					Depth 11.5'	12.9	11.1	10.7	proxim 11.9		12.4	10.9	12.7	12.8	14.5'	13.8	11.8
Depth int.	10.9	—	—					Br. 14.2	17.3	13.5'	12.5'	—		11.2	10.3	11.5'	12.5'	13.9	13.3	10.8
Int. ant. depth to shaft	10.35'	12.7	—					Br ext 8.9	9.1	8.3	7.3				9.3	9.8	10.5'	12.8	10.7	17
Br sh	8.8	10.0					carpus ant-post	17561 10.3	12.0	11.9	10.6	Mike Bell S. well. 8.4 ethi		9.3	7.7	9.0	9.0	10.8	9.9	8.7
Br dist	—	—	17.1				ext	7.1	8.9	7.8	7.1			14.3	12.1	14.1	14.6	16.5'	17.7	13.6
Sh br. through fract M1	—	—	10.1				Br m2	6.5'	7.9	7.1	6.2			8.85'	7.35'	8.5'	9.1	10.6	8.5'	8.8
Ht mid troch post	—	—	10.2	tarsus 17558 9.7 B? sp										7.2	6.3	6.8	7.4	9.3	10.8	7.3
Br hypo	7.6	9.0	—											7.7	7.9	9.3	9.5'	10.8	10.2	7.6
Humerus				sp. C ✓																
Br dist (gr.)				15.3									Mr. vaga. Shackleton 17496 17.5	20.6	16.6	18.7	19.5'	21.0	24.0	(20.4) 19.1
Br. condyles				11.9										15.5'	11.4	13.0	13.2	16.0	17.6	14.4
coracoid					sp. B ✓															
Br at glenoid					15.6									12.8	10.1	12.1	12.9	14.5'	17.5'	11.7
Br at scap fact				Rats	16.4 ✓	about size (little one)								14.3	12.4	13.5'	14.0	16.0	19.5'	13.4
Br at top glenoid				69.1	14.9	m. [illegible] larger than S. [illegible]								12.0	10.0	11.5'	12.5'	14.3	17.3	11.6
Below scap fact to head					23.8 ✓									20.8	17.0	19.8	19.6	22.0	26.2	19.4
carpometacarpus						sp A ✓														
Depth P r w						17.7 } 88.470								17.2	14.1	73.5' 16.0	79.5' 17.2	81.3 18.6	80 20.1	16.1
ext troch & symph.					58.170	19.8							82	21.0		21.8	21.6	22.9	25.0	14.7
Br tr.				65		8.3								7.9	6.8	7.4	7.5'	8.9	9.8	7.5'
Ht M I int						11.5'							51.0	10.7	9.5'	10.6	11.4	12.5'	12.4	11.1
Depth sh prox thru m2 & 3						8.9								8.2	6.9	7.6	8.3	8.8'	10.0	8.2
tibiotarsus dist sh above dist end							10.5'												9.5'	
b Br dist		$\overset{b}{14.2}$	$\overset{a}{11.0}$	$\overset{c}{4.8}$ x	$\overset{e}{13.4}$ M. [illegible]		13.4	D ✓						11.5'	9.8	11.5	11.7	13.9	12.9	11.1
c Br. int condyle							4.2											2.	3.6	
d Depth dist ext							11.1	proportions of Morus						8.3	7.1	7.9	8.4	9.9	10.4	8.4
e Depth dist int							13.1							9.7	9.5	10.8	10.8	13.1	12.0	10.6

Radius 17568 has large pneumatic foramen medially on
surface that articulates with ulna and shaft is deep
on opposite surface raised area goes past middle,
Radius 17572 this last-named raised area is ext. to middle
& on other side there is no foramen & bone is flatter
This bone is more like S. leuco & M. bassanus, but without foramina; but 17568 is
more like S. dactylatra ~~[illegible]~~

Sulidae cont'd

Leisure World

size bet vagabundus & dactylatra

	Radius # 17572 sp. E ✓	worn # 17568 sp A ✓	# 17574 sp. B ✓	not #				distal tibiotarsus Microsula recentior	[illegible]	ext depth		M. vagabundus 17496	[illegible] 7432	1339 S. sula websteri	min S. leuco brewsteri # 1349	251	max 1352	S. dact. 1356	M. bassana 18173	S. nebouxii 253
Br. dist 10 4?	9.9	10.6					gr. ant br.	14.2	13.3	depth ext 6.9	6.5			10.6	8.6		9.8	11.4	12.6	(10.8) 10.3
Depth	4.45	4.75					post br.	12.0	11.7	height dome condyles 11.3	10.9			4.0	2.9		3.7	4.0	3.4	(3.7) 2.9
Br sh	5.0	5.0 } 84.					depth ext	11.3	11.0	x top of bridge 10.1	9.3		81%	4.8	4.6	63.1 72%	5.1	5.4	6.3	(5.9) 5.5
Depth sh 68%	3.4	4.2					depth int	13.5	13.4					3.9	2.9		3.7	4.3	4.05 63	(3.55) 3.1
Prox end dimen			6.8 x 7.5	7.5 x 8			ant. depth	~~17.~~ 13.2	13.4					6.1 x 7.5	4.8 x 5.5		6.0 x 6.6	6.7 x 6.8	6.9 x 8.6	5.7 x 6.3
							quadrate gr. length 20.8	17464						16.2		15.6		gr. length 21.9		16.8
	Cuneiform 17562 sp. A?.						br. upper part 9.6 br 6.7	8.7 6.2						7.0 3.6		8.0 6.4		10.8 7.0		9.1 6.0
							gr. lower 16.1 sep. lower 8.2 x 4.3							15.2				11.7 8.8 x 4.7		
gr. dimen	12.2													11.5	9.3		11.5	13.0	14.6	10.3
→	10.0													9.1	8.2		9.3	10.1	10.8	8.7
	Distal ends carpometacarpi 17548	17558	sp A ✓ 17561	17553	sp E ✓ sp A ✓ 17579															
gr. br	8.6	(8.9)	(8.9)	7.9	(9.3)									8.9	7.4		8.5	9.7	10.5	8.5
depth ext	6.6	—	7.2	6.45	7.4									7.9	6.2		8.1	8.0	8.9+	7.0
gr. Br. sh M 2	—	6.27	6.3	5.5	(7.1)									5.8	5.2		6.3	7.2	8.1	5.8
Dimen across symph.	—	—	12.84	10.7	—									13.4	10.5		12.8	13.6	15.0	12.6
	Humerus shaft 17567																			
br. shaft below crest	9.0											9.8	10.4	10.4	8.0	9.5	10.2	10.8	14.3	8.7
depth same	5.4											7.0	7.6	8.6	6.4	7.5	7.6	9.0	9.5	6.7
br. below on shaft ✓	8.0											8.9	10.0 ✓	10.0	7.5	9.0	9.4	9.9	12.9	8.4
depth same ✓	5.4											7.0	7.0 ✓	8.4	6.3	7.4	7.5	8.5	9.5	6.7
Dimension of scar on deltoid	8.8 x 2.6											10.3 x 3.7	10.4 x 3.4	7.9 x 3.6	6.4 x 2.9	8.3 x 3.4	8.7 x 3.4	10.7 x 3.8	15.0 x 4.9	8.3 x 3.1
Ratio ✓	67.4													84.0%	84.2	82.3	79.7	81.9	73.5	79.6

El Toro

~~Five~~ ~~most of the~~
~~Eight~~ Other Sulid specimens, all water worn, are markedly larger,
~~All are of dark color~~
and possibly represent a single species. They include
2 ~~a~~ distal fragments of ~~carpo~~ carpometacarpus (1) + 1 of radius (1), ~~etc~~
6 ~~tibiotarsus~~, prox frags of tarsus (1) + carpus (1)
and a quadrate. ~~Ex~~ Distal frag. of tarsus (1) + ~~tg~~ of ulnas (1)
in the same ~~state~~ of preservation were recovered
from loc 65120

A tibiotarsus (lighter in color, tho well petrified,
but not water worn 13.8 br. 13 depth 94% (13.9 × 12.3 Sula dactyl 89%
13.1 × 11.9 M. bassanus 91%

lower end of bridge about on line with medial contour of
ext. condyle as in Morus. Sula nearer center of bone
(and dist end flatter than Morus

Dist end radius less flattened than Morus, has
ridge up side on palmar face with large pneumatic
foramen in center of bone along the ridge. Ridge ok for some
Sula, but no foramen here (more lateral in all as well
as Morus. Br. dist end less than S. dact. (10.3, S dact 11.7
M. bassanus 12.6

Dist end tarsus 17. (S. dact 16.4 M. bass. 17.5
shaft 9.8 × 5.6 (dact, 10.3 × 4.7, bass, 8.6 × 5)

Dist end carpus, size = S. dact. (slightly smaller)
int. edge of shaft more acute (dact more rounded, bass
more acute but larger throughout)

Quadrate smaller than dact.

Prox ~~carpus~~ lacks foramen above prox M) (as in Morus,
but doesn't seem to have them laterally either, M. 3 bones
ant lat. + curves medially prox. more like Morus, sharper in Sula
slightly smaller than dact.

Coracoid 16.5 broadest pt (scap facet), 13.8 gr. ht. clavic. facet; below glenoid to head 24 mm. Same meas in S. dact are 16.1, 13.4 and 22.6; in Morus bassanus 19.6, 16.7 and 26.6

Depth sh 16.8 below procora. (dact 17.0, M. 17.8)

Br. through glenoid 15.1, br glenoid 8.5; (dact, 14.5, 8.2; M. bass. 17.6, 10.3)

procoracoid to scap facet 9.1 (dact 9.4; M. bass. 11.1)
water worn

Miocene

Laguna Hills Loc 1945

Telidae

Sulidae El Toro

Six (contr. radius)
Five large water worn specimens represent a large sulid

rad gray prox possibly more Morus 17574

carpus worn " " " " 17566 lacking pneumatic foramina differs from both Morus & Sula but absence prox bet. trochlea & M1 process is true of Morus but not Sula

Morus? X
larger than nebouxi
~~prox~~ prox carpus worn

M1 is more bowed than in Sula, Morus, too has tendency to bow (at prox junct.)
Size larger than Sula nebouxi, smaller than S dactylatra (much smaller than bassanus)

carpus dist — 17579 nothing diagnostic here bet Morus & Sula
larger than nebouxi
Size bet nebouxi & dactylatra (much less than bassanus)

gray cuneiform 17562 size about as in dactylatra (smaller than bassanus)
Morus?
larger than nebouxi X
closer to Morus in chars.; pneumatic foramen at apex (absent in Sula but lacks foramina ~~at~~ under (a) ~~fossa~~ ~~in~~ both genera

gray scapula 17576 shaft ~~as stout~~ as in M. ~~bassanus~~ but not as wide (hence proportionately stouter

? Large as dactylatra or more

external border below scapular facet more rounded than in Sula more like Morus, but artic facets worn off so nothing char. left

brown scap. 17560 has pneumatic foramen on dorsal side of acromion as in Morus not on ventral side as in Sula
larger than nebouxi Morus X
Bet. nebouxi & dactylatra in size; arrangement of muscle attachments under scaps facet resembles dactylatra (surface both ventral & dorsal

lt tan gray scap 17559 size as in 17560 but no char. preserved

coracoid 17569 size a bit larger than dactylatra but smaller than bassanus
larger than dactylatra
neck lacks depth of depression of Sula, more like Morus

10.8 9.2
16.8 15.0 14.6 11.7
19.7 16.6 16.6 13.0

X Triosseal canal with small pneumatic foramen not very much depressed & area anterior to " " in triosseal canal fairly flat (as in nebouxi) bassanus very rounded & dactylatra also tends to round. Bone thrust outwards ~~forwards~~ at scapular facet to less degree than in M. bassanus (Br. through this canal is over 90% of ~~[illegible]~~ br. at scap facet (in bassanus it is 85%)
Small lig. attach. on ventral side of head below apex clearly depressed as in Sula and about at level of top of glenoid facet (also as in Sula) higher rel. to glenoid in Morus

Sula?

radii mea

dist worn bum — radius 17568, has large pneumatic foramen in long longit. depression as in Sula but more centrally placed The foramen & depression are near the medial border in Sula & the smaller foramina of Morus also are near the medial border. Shaft more convex on ulna side than in bassanus more like Sula, S. ~~Br~~ size bet. nebouxi & ~~[illegible]~~ leucogastra (hence smaller than other elements noted) Depth of shaft bet. nebouxi & dactylatra (deeper in proportion to breadth)

Sula ?, X

S smaller than nebouxi in dist. br but heavier shaft

dist unworn — radius 17572 lacking pneumatic foramina, flatter shaft than 17568, ~~[illegible]~~ [tip varies] & also Morus like in position of muscle attachment somewhat depressed along lateral edge; ~~[illegible]~~ in Sula it is ~~more~~ raised & is ~~situated~~ on the sloping lateral side of the convex shaft not near the edge

Morus ?, X

Distal carpi close to size of nebouxi — 17558, 17578 & 17561 have no diag. chars. bet. the genera but none has foramina in the dist. metacarpal symphysis (int. side) tho both Morus & Sula have them, Size is close to ~~[illegible]~~ nebouxi

Dist. rt carpus — 17555 is smaller than the other 3 (bet nebouxi & min leucogastra) Like the others, it lacks the foramen in the symphysis

S smaller than nebouxi

dist humerus — 17556 – Brachialis impression less depressed than in Sula [than Morus] olecranal fossa narrow & deep as in Sula also with small foramen inside lateral border as in Sula also ext. scar turns at ~~a~~ more acute angle onto palmar surface than in Morus (more like Sula), facet for ant. artic lig. rel. broader than ~~in~~ Sula & facing more distally palmad (dactylatra is like the others!) Also like dactylatra in ball like int. condyle

Sula X

S smaller than minimum leucogaster

Tarsus prox — 17554 Prox br. as in nebouxi & br. hypotarsus (13.3/7.2) br sh 8.7. Intercotylar ridge a prominent ptd ball anteriorly as in Sula (clear & rounded in Morus. Ant. trough of shaft deep & steeps sided both ~~[illegible]~~ ext'ly & int'ly (int. border in Sula more gradually sloping, muscle attachment further from prox tip (12.5 mm. as contracted with 10 mm in nebouxi; Hypotarsus: ~~[illegible]~~ much shorter ridge ~~about twice as deep partly as and~~ than int. both longit. & postly; ext ridge also slants postly but with continuation down shaft median to foramen forming a depression bet. it & the ext. ridge not evident in any of the Rec. specimens at hand.

& also larger specimens of leucogaster

Tibiotarsus 17570 Morus X

Sulids from "El Toro" $\overset{\text{LACM loc 1945}}{}$ Possible identity

Dist end humerus 15,3 br.

Sula willetti		S. humeralis	19.8
Sula avita	15.2	M. vagabundus	17.2 - 18,3
Sula pohli	18.2		

Prox end tarsometatarsus (cotylar br.) 12,1 br, sh 10.0

Sula willetti ref. prox no $\overset{10.5?}{11,9}$, type $\overset{9.5?}{12,0}$ $\overset{\text{ref.}}{\text{br sh}}$ 8,5 br sh type 6.8

Prox end tarsometatarsus (vts.) 13,3+

Miosula media 14.2 (cast of type)

✓ Morus lompocana type 13.5?, 13.3 ref (17.3 ref on dist end)

17.

Dist. end tarsometatarsus 17.1

Mio-sula media 15.7 (cast of type

✓ Morus lompocana 17.3 ref. (same specimen as prox. above)

Coracoid gr br. at scap facet 16.6; lt procora to head 23.8

	Sula pohli	13.7	17.6
✓	M. peninsularis	17 - 17.7	25 - 25.1
✓	M reyana	17.1	✓ 24.7
	S. guano	14.7	21
	S. phosphata	13.8 - 14.5	21
	M. loxostyla	13?	15.5?
	S. willetti		19.3?
	S. humeralis	20.4	27.0
✓	M. lompocanus	—	23.4

Carpometacarpus depth prox through M I - 17.75, $\overset{\text{least}}{\text{depth}}$ MII,

Sula universitatis smaller than humeralis, Miosula etc

larger than willetti & avita @ Brodkorb

Sulidae p?

are not discernible. In size, however, it seemingly accords with the bones from Laguna Hills

meas
what bones
can be meas.
in breadth
& compare
with leucogaster

Other sulidae 16 large (not counting gray bones (5 more)

Dist. end tibiotarsus (M lompocana?) 17570
" " tarsometa. (" " ?) 17580 (loc 65120)
Prox " " (" " ?) 17565
" " carpometac (" " ?) 17564
" " coracoid R (" " ?) 17569
Dist end ulna (" " "?) 17581 (loc 65120)

2 " " radius 17568 Sula?
17572 Morus?
2 " " carpometac 17558 and 17561 both could be lompocana
2 " " " 1~~[illegible]~~ 17778 smaller?, 17779 waterworn
1 shaft humerus 17567 — smallish could be Microsula
1 Quadrate 17777 large
1 frag " 17564
2 scapulae (frag) 17559, 17560
1 pedal phalanx 17571
1 cuneiform 17562 (gray preservation)
1 prox end radius 17574 " "
1 dist frag tarsus 17575 " "
1 prox end ulna 17563 " "
1 scapula 17576 " "

A fragment of ~~humeral~~ shaft below the prox. end (LACM 17567)
~~suggests the small size also reps. a small sulid~~ may belong
to this same small species. ~~The breadth is~~ Proportions ~~show~~ the
shaft to be broader & flatter than in Sula leucogaster (ratio
5.2 X 8.3 62% (S. leuco 6.2 X 7.2 85-86%). The line of the latissimus dorsi anterior muscle is centered
on the ext. side of the shaft as in Sula as contrasted with Morus, but the
attachment of the latissimus dorsi posterior is close to the edge of the deltoid
crest, ~~and this~~ crest itself is less prominent than in Sula."

made, however, in view of the fact that the tibiotarsus of Miosula media, which can be seen on a reverse cast of the type, is also of large size and seemingly similar proportions to Morus and the Laguna Hills bone.

Morus sp. (4)

A complete cuneiform (LACM 17562), a distal end of radius (LACM 17572), a fragment of the articular end of a scapula (17560) and a middle trochlea of a tarsometatarsus (17575) all show characters similar to those observable in comparable elements of Morus. All are smaller than a Recent specimen of Morus bassanus, (Lacm no.) and only slightly exceed ~~those~~ the maximum of four specimens of Sula leucogaster brewsteri. check sep. 14

1 The radius lacks pneumatic foramina, Otherwise it resembles Morus rather than Sula in that the ulnar face immediately above the distal articulation externally is a broad smooth, shallow depressed area, and the apex of the shaft is nearer the internal side. However the apex is more strongly marked than in M. bassanus and extends to the distal facet; in M. bassanus, it stops above the level of the ligamental prominence. This specimen is in marked contrast to the radius (LACM 17568) descirbed above, which bears a large deep foramen-like depression and has a more prominent ligamental prominence and deeper shaft.

Keep

2 The cuneiform resembles Morus in the presence of pneumatic foramen at its outer apex (a foramen which is absent in Sula) but it lacks the other foramina within the bend of the element that occur in Recent specimens of both Sula and Morus.

3 The scapular fragment ~~has a~~ small pneumatic foramen on the dorsal side of the acromion as in Morus; in Sula this foramen is relatively large & is ~~and lacks the ventral foramen char-acteristic of Sula.~~ visible from the ventral side

4 The metatarsal fragment, consisting only of the middle trochlea, resembles Morus in the high proximal extent of this trochlea posteriorly and the smooth blending of the trochlea with the shaft both anteriorly and posteriorly.

Suborder Pelecani

Family Sulidae, Boobies & Gannets

Twenty-four fragments are assignable to this family and may represent as many as five species. Definite assignment, is, however, extremely ~~[illegible]~~ difficult ~~as~~ in only a few instances ~~can are parts~~ ~~specimens represented~~ can the same elements be compared. ~~On the basis of size in comparison to skeletons of living sulids, the different tibiotarsus,~~ ~~are diag~~

~~2~~ Only ~~11~~ 12 specimens ~~are sufficiently~~ show characters that assist in identification

Morus, sp. ① ~~(= 2)~~ (= D in 1st list)

~~The following specimens are assigned to~~

~~Morus:~~

1) Tibiotarsus, distal end no. 17570, has the relatively great anteroposterior depth, ~~[illegible]~~ especially of the external condyle which characterizes this genus in distinction to the rel. broad, flat tibiotarsus of Sula. ~~Actual size~~ The species is greater in all dimensions than the single specimen of M. bassanus available for comparison, altho ~~in~~ in br. it is less than in dactylat, both ext. & int. condyles deeper.

Morus, sp. ② (= part of A in first list)

A Carpometacarpus, proximal end no. 17566 ~~differs from~~ ~~Morus & Sula in lack of pneumatic~~ ~~Recent specimens of both Morus & Sula in this element is less pneumatic than~~ ~~foramina; as in Morus at least~~ however, resembles Morus ~~at least~~ in the ~~tendency for~~ tendency of M1 to curve away from M2 at the prox symphysis. Also, ~~in the~~ the area between the trochlea & the process of M1 lacks pneumatic foramina. The fossil is even less pneumatic than Morus, however, lacking any evidence of foramina in this prox portion. In size the specimen is markedly

smaller than in *M. bassanus*, being, between ~~only slightly~~ (~~and~~ & S. dactyl.
~~above~~ ~~the max. avail. specimen of~~ S. leuco. in size,
~~depth of prox end from tub. to tip of process of 1~~
~~and ht of this process.~~ Hence it seems improbable
that the carpus & tibia rep the same sp.

A complete *cuneiform* no. 17562 resembles
Morus in the presence of a pneumatic foramen
at its outer apex (a foramen absent in *Sula*) though it
A lacks the other foramina ~~found in~~ within the bend
of the element, which occur in living specimens of
both *Morus* & *Sula*. The bone, in length the cuneif is between S. leuco
& S dactyl. ~~in size~~

Radius, distal end 17572, is entirely lacking in like that of *M. bassanus*
pneumatic foramina; also the muscle attachment is nearer ~~along~~ the
A the ~~lateral~~ lateral ~~edge of~~ margin of the shaft & is somewhat
depressed; in *Sula* the attachment is more medially placed
& is more raised. The dimensions of the specimen
suggest that it may belong with the carpus & cuneiform.

Scapula, incomplete articular end no. 17560,
has a pneumatic foramen on the dorsal side of the
A acromion as in *Morus* & lacks the ~~foramen is ventrally~~
ventral foramen character. of *Sula*. Precise measure-
ments cannot be made on this specimen but visual
comparison indicates a size ~~between~~ in keeping with the ~~...~~
three specimens above described.

Tarsometatarsus 17580 from loc 65120 ~~also~~
highly mineralised, waterworn & with hard matrix (diff from
D? surrounding matrix) adhering, also reps. a large *Morus*
about the size of *M. bassanus*. Chief *Morus* chars are:
midtrochlea less markedly protruding ~~[illegible]~~ from level of shaft
both ant'ly & postly, & posteriorly extending farther proximally to
terminate in a distinct point; shaft more compact & ant'ly foramen
& longit groove ~~narrower~~.

6.16.66

Family SULIDAE Boobies & Gannets

Twenty-two ~~Nineteen~~ fragmentsassignable to the Sulidae were collected at locality 1945. Sixteen are the darkest color preservation, and eight of these are water worn. Six bones are lighter in color but still well mineralized. At least two, and possibly three species are represented. Two bones from loc. 65120 resemble the dark, water worn specimens in preservation /

Microsula Wetmore

A distal end of right humerus (LACM) is almost identical in size with the type humerus of Microsula avita Wetmore from the Middle Miocene, ~~xxxxx~~ ~~Miocene,~~ Calvert Formation of Maryland. The specimen also resembles M. avita as distinguished from Sula leucogaster in the near obsolescence of pneumatic foramina, less depressed brachial impression, slight development of the ectepicondylar prominence, relatively broad, short surface of attachment of the anterior articular ligament, prominent, globular internal ~~broad, blunt tip of external~~ condyle, and braod, blunt tip of external condyle (the latter character is, how~~ever~~ also, true of the genus Sula, ~~also,~~ in contrast to Morus).

There are at least two characters recorded fro M. avita tht differ in the Laguna Hills humerus. The latter specimen is therefore made the type of a distinct species named in honor of Dr. Alexander wetmorei who ~~named~~ described the genus, ~~Microsula.~~

Didn't describe because of possible identity with the Sula (=Microsula?) willetti,

Microsula wetmorei new species

Type: Right distal end of humerus (LACM), collected, Jan. 1965.

Locality and age: LACM loc. 1945, Leisure World, Laguna Hills, Calif., late Miocene?

Diagnosis: Resembling Microsula avita in size and generic characters set forth above, but distinguished as follows: olecranal fossa deep and more rounded than oval in contour; surface for attachment of anterior articular ligament as broad distally as proximally (not triangular); brachial impression more deeply impressed in its distal than in its proximal half.

Size seemingly accords with Sula willetti, ~~and~~ but detailed characters of that sp. cannot be seen on the unfigured specimens. Should future studies indicate ~~specific~~ identity, S. willetti will properly be assigned to Microsula;

Measurements: Breadth of distal end, 15.3 mm.; greatest depth of distal end (through external condyle), 10.0 mm.; length of attachment of anterior articular ligament, 4.5 mm., breadth of same, 3.0 mm.; proximodistal dimension of internal condyle, 5.4 mm., lateral dimension of same, 6.0 mm., greatest proximodistal dimension of olecranon fossa, ~~x~~ 5.3 mm., greatest lateral dimension of same, 6.0 mm.

Referred material: Proximal end of left tarsometatarsus (LACM) and distal end of incomplete right carpometacarpus (M 2 and distal symphysis) ~~xxxx~~, both from locality 1945 and collected in January 1965.

Both referred specimens, as well as the type humerus, are near in size to a minimum specimen of Recent *Sula leucogaster brewsteri* (LACM no. B11349), but ~~both~~ lack the pneumaticity found in ~~of~~ that species. In the tarsometatarsus, the internal tendinal canal is larger than the external as in *Sula*, and the middle and internal ridges are more nearly bridged together than in *Morus*, but less distinctly than in *Sula*; the shaft tapers more abruptly from the proximal end and the anterior face of the shaft is more deeply, more evenly and more narrowly depressed than in *Sula*; posteriorly the external side of the shaft below the hypotarsus slopes acutely to the base of the internal calcaneal ridge (~~is~~ not flattened as in *Sula*). The distal section of carpometacarpus resembles the illustration of this element in *M. avita* from Maryland, as contrasted to that of *Sula leucogaster*, in shorter ~~distal~~ symphysis, absence of foramina on the external surface of same, ~~and~~ more prominent, more distally extended protuberance bearing the facet for digit 3, and deeper, more anteriorly deflected tendinal groove on external surface of shaft of ~~Mx~~ M 2.

The humerus is notably smaller than ~~that of~~ *Sula pohli* (meas. of dist. br. as given by Howard, 1958 is 17.5 mm.) or the Pliocene S. humeralis (br. 19.8 mm.). Comparable measurements are not available for *Sula willetti*. However, comparison of the tarsometatarsus with outline of this element seen in the type of *S. willetti*.

$6.25 : 5 = X : '$

Loc 1945

Alcidae notes removed temporarily for use in San Mateo fm study

Aug. 10, 1978

Leisure World

Laguna Hills (site formerly called "El Toro") Loc. 1945

Late Miocene

Data on Alcidae

6.23.67

Order Charadriiformes

Family Alcidae -

Twenty-~~four~~ seven fragments represent the Alcidae or the closely related Mancallidae. Because of its close similarity to the true alcids this latter group has been given subfamily ~~status~~ in the recent ~~compilation~~ catalogue of fossil birds (Brodkorb 1967). In view of certain specimens found in the present collection, the differences in the groups becomes even more difficult to define. In addition to the extinct Praemancalla lagunensis already described from the locality (Howard, 1966), at least six other species, representing 4 or 5 genera, are represented,

over →

Alcidae, sp. 1 (A)
[~~Cerorhinca dubia Miller (?)~~]
(Sacm)

A single left humerus, lacking proximal end and with distal ~~contour~~ partly preserved ~~the internal portion of the distal end~~, agrees in size and general proportions ~~of the shaft~~ with Recent specimen SACM 31476 of Cerorhinca monocerata. [The type of C. dubia from the Miocene diatomaceous shales of Lompoc, Calif. consists of the impressions of the leg bones which also correspond closely to those of the Recent species.] ~~Distinctions are noted~~ Principal distinctions as far as they can be observed on the fossil, are found in more distinct, abrupt depression ~~of the shaft~~ along the medial margin of the bicipital surface (proximally) and, possibly, a shorter more distally directed surface for attachment of the ant. articular ligament (distally). Of previously ~~described~~ recorded Tertiary alcids, the specimen might possibly have belonged to the species described as Cerorhinca dubia Miller (1925), ~~from the Miocene diatom~~ of Lompoc Calif. Only the leg bones, impressed in shale, are known of C. dubia, but these, like the humerus here noted, have the size proportions suggestive of C. monocerata. An incomplete coracoid probably belonged to a bird of the same size

The humerus, ~~the~~

over

~~Previously recorded~~ Tertiary alcids, seven in number ~~do not~~
~~mancallids are not numerous, usually~~

Previously recorded Tertiary alcids and mancallids are: Miocene, Cerorhinca dubia Miller, southern Calif.; Miocepphus mcclungi Wetmore, Maryland, Uria antiqua (Marsh), No. Carolina; Pliocene, Uria ausonia Portis, Italy, Australca grandis Brodkorb, Florida, and from Southern Calif., Brachyramphus pliocenus Howard and Ptychoramphus tenuis Miller & Bowman.

~~The presence of a well formed foramen in the procoracoid & the extension of the procoracoid for some distance along the shaft is similar to the coracoid of Cerorhinca, Uria [illegible] the foramen is placed nearer the scapular facet in the fossil than in Recent specimens.~~

In general, characters are most like those of the coracoid of Uria. ~~although~~ Cerorhinca agrees with the fossil in presence of a well-formed foramen in the procoracoid but the foramen is much ~~[illegible] nearer~~ the scap. facet ~~more on the post. surf.~~ in the ~~dorsal~~ ~~and the procoracoid meets the shaft at~~ ~~the fossil~~ ~~[illegible]~~ the procoracoid meets the shaft at nearer the internal edge, not as posteriorly,

Alcidae

Cf. Toro fossil Humerus

fossil carpus coracoids

Ulna	olecranon qx Length / Ectepi	a Br prox	b Depth prox	x Length Brach. imp.	y ~~Bf~~ Br' Brach imp	Br / Depth sh	Depth ext / Br (ratio) dist end	Ratio yx	Ratio ab	
U. aalge 480	63.5 / 62.3	8.0	9.8	15.6	2.8			17.9	81.7	
Lunda 696	61.5 / 60.8	7.7	9.1	15.3	3.1			20.2	84.5	
Alca 1849	59.5 / 58.1	7.5	9.2	14.1	2.2			15.6	81.5	
Pinguinus	58.7 / 58.0	9.7	12.6	15.5	2.0			12.9	77.2	
Cerorhinca 524	53.2 / 52.5	6.6	8.0	11.2	2.2	3.1 / 4.9		19.6	82.5	
Cepphus 1173	56.2 / 54.7	7.1	7.7	13.3	2.0			15.4	92.3	
Ptychoramphus 517	38.2 / 37.4	5.1	5.8	8.5	1.8			21.2	88.0	
Brachyramphus 1176	38.6 / 38.5	5.1	5.9	9.5	1.6			16.9	86.4	
Endomychura 467	35.2 / 34.7	4.8	5.7	8.6	1.6			18.6	84.4	
Synthliboramph. 693	39.7 / 38.8	5.0	5.9	8.8	2.0			22.8	84.6	
Lag. Hills tiny comp.? aethia? M. per	36.2 / 29.3	4.0	4.0 or 4.1	8.2	1.3?	1.7/2.2	3.2 / 2.2	18.3		
" dist	—	—	—	—	—	1.7/2.3	3.2 / 2.2	—		
B. Lag. Hills prox end (narrow, breaks)	—	6.2	7.2	bone breaks 10+	1.8	w/ prox 3.1 / 5.0	—	18.0		
Laguna Hills fossil "D" alcodes	30.9 / 30.1	5.4	7.5	7.9	3.1	2.9 / 4.5	5.5 / 3.8	39.2	72.0	
Prox end "D" only alcodes	—	erosion 5.8? 6.0?	—	8.2	2.8	3.2 / 4.7		34.1		
distal end only "D" alcodes	—	—	—	—	—	—	5.7 / 3.9	—		
larger prox. end only "A"?	—	7.3	—	16.4	3.8	4.0 / ~~4.8~~ 5.8	—	33.4		A?
Mancalla S.D. 2982	25.8 / 26.1	5.4	7.9	narrower more median 6.3	3.0	3.1 / 5.1	6.0 / 4.3	47.6	68.4	
Cedros I. 15412	28.6 / 28.7	6.25	8.85	8.3	3.3?			40.0	71.6	
" 15377	32.1 / 32.2	6.9	10.0	8.4	3.8			45.0	69.0	

Ulna	A	Tiny F	with "C" ulna frag	"D" (Ph' fact 1.4)	A? Right	Left	Left	tiny right	less comp tiny right	tiny left
U. aalge 480	Length to pectoral crest 57.4	—	—	Depth prox 8.1	br trochs 4.3	4.0	3.7	2.4	2.0	2.1
Lunda 696	Shaft 3.7/6.2	2.0/2.4	3.2/4.6	Ht M1 7.25	ht to below scap fact 13.8+	—	—	—	—	—
Alca 1849	Ht ectep. 8.7	4.5	—	ant. post mech br. 3.7/2.1	foramen to lower edge scap fact 3.1	none?,	none?,	1.8	1.6	1.6?.
Pinguinus	inc 6–7 mm ←	br dist 4.1	—	Symph to prox 8.1/7.7	Shaft below procoracoid 3.6/4.1	—	3.1/4.0	1.9/2.3	1.5/2.1	1.4 / 2.0
Cerorhinca 524	frag.		"F"	ext int tiny distal	scap fact to top glenoid 9.5	8.4	8.4	4.5	-	3.9
Cepphus 1173	Br sh 3.2			br dist 2.5	br. glenoid 4.4	5.0	4.6	2.2	—	1.9
Ptychoramphus 517	dist width 4.4			ht dist symph 2.7						
Brachyramphus 1176										
Endomychura 467	unc fossil tarsus prox end			1	# Cerorhinca 537	coracoid ct #538	#19			
Synthliboramph. 693	length inc 37.++	— —			sh 3.5/4.6	3.3/4.1	3.3/4.4			
Lag. Hills tiny comp.	Br. prox —	7.9			scap fact to glenoid 9.5	8.3	7.8			
" dist	Br/depth sh. mid: 3.6/3.3	3.9, 3.2 new prox end			br glenoid 4.1	4.0	3.8			
B. Lag. Hills prox end	3.9/3.2 at same place as				foramen to scap fact 5.3	4.7	4.7			

Tarsal lengths alcidae

		prox sh		
Cepphus	36.7,	7.0, 2.8	(humerus	66.2
	36.8,	7.1 2.7	"	68.0
	36.2	, 6.9, 2.4	"	68.8
Cerorhinca	28.4	6.2, 3.8	"	65.4
	29.8	6.4, 3.2	"	67.4
	27.7	6.1, 3.4	"	66.4
	29.2	6.6, 3.7	"	68.5

Alcid ulnae
2 (1 complete, 1 dist frag)
1 " short n. sp.
1 dist. " " "
1 prox " " " (but larger
1 large broken prox
1 med prox (narrow brach imp.)

A 3 (or 4 if femur here) Cerorhinca ? sp A

which is this? Humerus gray 18283 Alca sp., 18275 tentative to Cerorhinca sp.

that prox end femur resembles Uria aalge

Coracoid with oval glenoid facet Alca sp. 18282

Large ulna prox short deep brach. imp. 18272?, Alcidae sp. ~~18274~~ ~~assigned~~ ~~Cerorhinca sp.~~

B 2 Cepphus ? B

2 coracoids ref. Alcidae sp. 18276

C 1 Sp C

1 prox ulna (narrow brach imp.) 18274 assigned Cerorhinca sp.

D 3 Praemancalla ? new small sp, Pub'd as Alcodes ulnulus

~~Type~~ ref. carpometa 18278

Complete ulna Type 18277

Dist end ulna ref. 18279

E 1 Separate sp, Praemancalla ref. tentatively Alcodes ulnulus 18280

Prox end ulna similar to comp. one

F 7 Tiny sp, Aethia rossmoori n. sp.

3 coracoids tent. ref. A. rossmoori #s 18952, 18954 (2 bones)

1 humerus ref. 18949 to A. rossmoori

2 ulnae ~~prox frag~~ comp. rt. ulna Type 18948, A. rossmoori

dist frag ulna tentatively ref. 18960, A. rossmoori

1 carpo, dist. ref. 18951, tentatively ref. A. rossmoori

G 2. Unassigned assigned Alcidae sp. 18273, 18281

2 large tarsi Cerorhinca A or

Praemancalla lagunensis

H 6 Praemancalla lagunensis

LNA Ulna

complete, sp. "D" = Alcodes ulnulus n sp. 18277

Endosyphia 56% imp to sh depth

impression 7.5 × 1.9 br. 25.3% (depth sh. 3.4) 2.2 × 3.3 Shaft middle 66.6%

prox 4.7 × 5.7 depth br.

Length 29.8 (to cotyla) 30.7 (to olecranon)

Prox. 5.5 (br. prox) 7.5 (depth prox) br = 73.3% of depth.)

Brach impress 8.5 × 3.1 (depth sh 4.9, thru brach imp. middle) br imp. = 36.4% length imp (63% imp to sh depth)

Shaft middle 2.9 × 4.4 br = 65.9% of depth

Distal 5.45 (depth ext.) 3.7 (br trochlea) 4.6 (br thru carpal tubercle)

max brach 8.1 × 3 (5.4)

3.35 × 4.9 prox brach

(5.65 × 3.9 × 4.5 broken dist)

Between Aethia pusilla 29.4/29.6 & A. pygmaea 32.3/33.2 in length

Slightly longer than Mancalla (Cedros #1541.2) but narrower (6.3 × 9.5) 28.7, 28.6

Rel. br. prox to depth prox 68 – 71% in Mancalla; (80% in Pinguinus; 83.7 Uria

Brach attach long & narrow in Pinguinus & no prominence for ant.-art. lig.
(depressed ~~int~~ beneath cotyla)

Brach attach in Mancalla short & deep & goes around onto palmar side, not clearly marked

Ant. artic lig. attach is prominent, forming broad surface with indentation before flare of int. cotyla

Incomplete prox + dist halves also assigned here (sp 'D')

The possibility that this ulna goes with Praemancalla lagunensis is discarded as humerus (type) of P. lag. measures 7.8 mm. br. across condyles, hence br. prox end ulna could not be less than 6.85 (or 7.5) if proportions agree with Pinguinus (87% or 96% in the 2 (dis assoc.) specimens) (97.5% in Uria) ulna is % of humeral br. in Pinguinus ulna/hum. in Uria 89.0% in Mancalla (Cedros 6.4 ulna 7.2 hum.)

Humerus to fit this ulna would be 6.3 mm – 5.6 mm in br. (6.2 mm if like Mancalla)

Whereas type of P. lagunensis is 7.8 mm br. size range would be 80% min/max if ~~this~~ ulna is same sp. as humerus

18278 Carpometacarpus (sp "D"?)		P. lagunensis	Pinguinus	S.D. 45.866 Mancalla	Alca Uria	Lunda Lat.
a ~~Ext~~ depth thru process	7.0	11.8	14.2	10.6	10.8	8.9
b Length process	7.2	14.0	13.0	15.2	7.8	6.1
c Br. prox troch.	3.7	5.3	6.5	4.6	5.4	4.8
d Distance dist tip proc to int/ext side of trochlea	9.5/9.6	16.9/17.2	17.5/18.2	18.4/18.9	11.8/12.7	8.8/9.
Ratio b/a	103%	118.5%	91.5%	152.5%	72.2%	91.6
Ratio b to int. d	75.7%	82.9%	74.4	82.5	66.9	65.3%
Ratio c/a	53.8	44.1%	44.9	61.3	50.0	54

Dist. tip proc. is distal to symphysis which is not true of any alcid except Pinguinus

Dist. tip proc. is distal to symphysis, Praemanc. or Mancalla

sp 'D' is less distally placed than in Pinguinus, Praemanc. or Mancalla

e Br. troch at post. dist tip	2.4 - 2.6?	3.7	5.4	2.9	4.9	3.8
Ratio e/c	65.-70	69.9	83.1%	63.0	90.6	79.2

hard to measure exactly so small

Prox tip of proc extends slightly prox to base of process as in P. lag. & to less extent Mancalla.
This is not true of Pinguinus, but is true of other alcids.

Proc. ant border broken but suggests slight concavity of contour but could be straight. However it is highly unlikely that it was convex as in Uria, Alca & Pinguinus, ~~or that~~ Clearly it did not have a distinct on prox tip as in with undercut as in Alcinae alcids. Fratercula (Lunda) have the least, but even these are more prominent prox. than sp 'D'.

Pisiform process is less blunt than in P. lag. but less prominent & nearer prox than Fratercula

Trochlea narrows posteriorly at distal tip as in P. lag. & Mancalla. All alcids wider (even Pinguinus)

Tiny distal end carpus has higher dist. symphysis than A. pusilla but otherwise similar even to [illegible]

El Toro alcids 6.7.1967 ULNA

Sp "A" ~~Dec 1964~~ ulna - inc. prox end longish" Alcidae, sp. 18272

① attach ~~[illegible]~~ ant. artic lig, rel. long, large, convex, raised above brachial impression

Closest to Cepphus tho Cepphus flatter

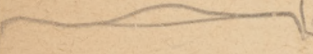
(Cepphus only one to be so raised along entire palmar edge 63.8% ⓑ

Brachial impression short & deep, length 14.5 × depth 3.7 (sh depth 5.8)

flat, not depressed acc. width. 25.4% ⓐ NONE like it

depth sh to length of impression → 40% ⓒ

		a	b	c
Aethia pyg. 7.7 × 1.9 (sh 2.9)		24.7%	65.5%	37.7%
" pus. 7.5 × 2 (sh 2.7)		26.6%	74.0%	36.0%
Cyclorhyn. 11.9 × 3 (" 3.8)		25.2%	78.7%	31.3%
Cepphus 12.8 × 2.3 (sh 4.7)		17.4%	47.5%	36.6%



Sp. "C" smaller than "A" Assigned Cerorhinca sp. 18274

② attach ant. art. lig, long, flatter than "A" Nearest Fratercula

and depression for brachial muscle only comes to middle

of attach, not along entire palmar edge.

Cerorhinca or Fratercula 1 sp.

Brachial impression narrow & depressed. Nearest Cerorhinca & Fratercula Lunda

Olecranon tip broken but seems to be straight prox'ly as well

as ancon'ly (not very deep anconally) Ptycho, short & stubby in Pinguin Lunda &

more pointed in Cyclorhynchus, Brachy, Endomychura Cepphus, Alca Synthli

Small depressed area between olecranon Fratercula & Uria

and ext condyle separate from descent of shaft, Cerorhinca, Uria, Cyclorhyn

(area long & narrow in Synthli, Ptycho, ~~[illegible]~~ smaller in Aethia

seems larger

Blends to shaft in Pinguinus, Alca, Cepphus

Endomychura, Brachy

assigned Aethia rossmoori n. sp. 18948

Tiny one

attach ant. lig. small & convex & brachial

SpF impression only comes to distal tip 8.1 × 1.4 (sh 2.4, br prox 4.0, depth 3.9)

③

3.7	4.4	A. pusilla
4.1	5.0	A. pygmaea
5.7	6.2	Cyclorhynchus

genus?, Bone not keellike as in Aethia only

(size = A. pusilla)

Olecranon very short & stubby — only one in which depth is less than breadth

Distally, carpal tuberosity forms hook Cepphus has a hook also

[other small dist. half of ulna not hooked; size same] but none of others has more than a prominent curved process

18960

Small flange overhangs tendinal groove ext'ly (dist.)

as in all alcidae, including Pinguinus

reduced in size in Mancalla & higher above distal end!

ne 7, 1967

CORACOID (see over also)

Tiny coracoids (2 rt, 1 left) + tent. assigned Aethia rossmoori n. sp. 18952, 18954 (2)

"Dorothy" Plautus not seen sp. "F"

Procoracoid medium length
Foramen middle position
but near shaft (nearest Endomychura but smaller)
(size near A. pusilla)

} Of tiny living forms nearest Endomychura & Synthliboramphus. Aethia, Cyclorrhynchus, Brachy. & Ptycho. have no foramen & have short procoracoid

---

Humerus Aug 15, 1964 (no prox.) Size of Cepphus columba but deeper shaft)

HUMERUS

sp. A. 58, 5 sp.: br/depth shaft, - closest to Uria, Lunda, Cerorhinca, Cyclorrhynchus, Brachy.
But of these Brachy & Uria are nearest throughout for shaft deepens across middle in fossil & in these = but stays straighter in the others 4

Deeper shaft, Alca & Pinguinus.
Narrower (more rounded shafts) Cepphus, Synthlib, Ptycho, Endomychura, Aethia

Cerorhinca ok

Pectoral attach. prominent (distal part not preserved) and separated from ext.-anconal apex of shaft by slight depression. (nearest Cyclorrhynchus Ptychoramphus)
Others have attach. closely appressed to shaft, with no distinct separate ridge

Distally (anconally) shaft bends toward palmar side. The anconal end of the int. condyle is gone, but the shape across anconal surface suggests that it did not protrude & was: more like Uria, Cerorhinca, Brachy, Alca & Pinguinus [Cyclorrhynchus & Ptycho. protrude)

Cerorhinca ok

Alcidae sp.

Ectepicondylar process with distinct papilla & tip as in Cyclorrhynchus, Brachy., lesser ext. Ptycho., Alca, Lunda
Uria & Pinguinus are more prominent along the ridge than tip

Brachial impression flat, area rel. broad & not sloped int., as much as in Pinguinus, Alca

Int. attach. faces slightly distal as well as int. as in Cyclorrhynchus, Synthlib. Uria

Bicipital surface raised with depression as in Uria, Alca
but it and deltoid crest
Pinguinus more raised, others less,

Tiny humerus (distal) cf. Aethia rossmoori n. sp.
Shaft narrow as in Aethia & papilla on tip of ectepi. also as in Aethia
Size as A. pusilla
Int. rel. broader & more depressed in brachial area (more like A. pygmaea in this)

18949

CORACOID   Otoro   (Humer

Alcidae – "sp. A" right coracoid (best preserved of the larger)
Dec 1944

Procoracoid of medium length (Uria, Alca, Pinguinis, Synthliboramphus, Endomychura
(longer in Lunda & Cerorhinca
shorter in Ptycho. Brachy., Cepphus (~~[illegible]~~
Aethia & Cyclorrhynchus

assigned Alca sp. 18282

Foramen about midway on procoracoid (Pinguinis, Synthliboramphus, Endomychura, Alca, Uria
(more distal in Lunda & Cerorhinca)
None in Ptycho, Brachy & Cepphus (sometimes but not often only a notch)
Aethia or Cyclorrhynchus

Procoracoid meets shaft at internal edge (Uria)
More onto posterior surface in all others that have long procoracoid & foramen

Uria or Endomychura sp.

Glenoid facet oval & convex (Pinguinis, Alca, Uria, Lunda, Synthli.
Round: Cepphus, Brachy., Endomy.
Oval & flat: Ptychoramphus

Marked apex on int side of shaft forming straight ridge which forms angle with anterior ventral edge (groove parallels ridge posteriorly
(Closest as to ridge & groove Endomychura
No ridge Pinguinis, Cepphus
Ridge indistinct & more int. in Cerorhinca
Ridge less distinct, not straight, & no groove in Uria & Alca, Lunda
Ridge straight but less distinct Lunda & not as distinct

Other 2 fossil left coracoids ("sp. 'B'"?) broken so that presence of foramen can't be ascertained. ① The more complete of the two suggests, however, that the break occurs at the distal edge of the procoracoid, & therefore the procoracoid is short as in Cepphus, Ptycho, Brachy, Aethia, & Cyclorhynchus. But glenoid facet is smaller & more round than sp. A. But still convex. Closest to Cepphus

assigned Alcidae sp. 18274

Cepphus sp. ?

Internal – ventral edge below head forms distinct angle
(but no ridge down shaft, like Cepphus, also Alca

② The other specimen seems more rounded at int.-vent. margin but ~~this may well be due to fact that the bone is broken further down than in #1~~; glenoid facet same as #①; procoracoid completely broken off.

El Toro Tiny alcids (3 coracoids, 1 comp 1 dist ulna, 1 dist 3/4 humerus
1 dist 1/2 carpometa)

coracoid has distinct foramen & procoracoid ~~ex~~tends long (or moderate?)
Rule out Brachyramphus, Ptychoramphus + Cepphus
because these have no foramen in procoracoid
and procoracoid is short Also rule out Aethia
& Cyclorrhynchus for same reason

ulna
Rule out long ptd olecranons: Endomychura, Cepphus
short ptd " : Uria, Brachyramphus.
short brachial imp: Cerorhinca, Brachyramphus, Endomychura

Only ones with rounded shaft (as in fossil) (not bladelike) are Aethia Endomychura + Cepphus
moderate blade Cerorhinca, Synthliboramphus, Ptychoramphus

has slight bend of coracoid too

Humerus
Least bladelike shafts: Ptychoramphus, Cepphus,

Alcidae

Description of small alcids from Leisure World

1895 2 and 18954 (2 bones)

3 Coracoids have deep, cup-shaped scapular facet with foramen well below it; ~~[illegible]~~ procoracoid extends down shaft.

(2 collected Dec 1964
1 collected aug. 15, 1964)
[This with other small alcids]

Genera That have foramen, are:

Uria
Cerorhinca
Pinguinus
Alca
Synthliboramphus
Endomychura
Lunda
Fratercula

8

Genera that have short procoracoid & no foramen;

Brachyramphus
Ptychoramphus
Cepphus
Aethia
Cyclorrhynchus
Alle

5

18949 Humerus (aug 15, 1964) distal end. ① Ectepicond. process prominent ridge with knob at top, distinct from less prominent ridge that connects to ext side of dist. end

② Int. condyle wide but shallow prox-distally

③ attach of lig. int. faces a bit palmad of lateral and

④ Above it int'ly is a tiny ~~d~~ pit. ⑤ Shaft (distally) is a bit more horiz. & broad than in some very flat ones.

Cyclorhynchus agrees in nos. 1, 4, 5 but lig. attach is more lateral & int condyle narrow & deep

Aethia pusilla is about same size but shaft more keeled like int. condyle narrower. Similar in no. 1,

18948 Ulna with ① low, rounded ~~acromion~~ olecranon ② rather rounded cotylae ③ shaft rather rounded & slender ②a ext. ~~[illegible]~~ very short as to "lip"; ④ Distally, ~~process~~ carpal tuberosity forms a little hook and ⑤ ext. a marked flange protrudes from the tendinal pit, ~~shaft shoulder~~ 6 prox. to ant. art. lig. convex.

Aethia pusilla same length but lip longer (2a), acromion more prominent ①, carpal tub. less hooked (4) but char 5 is same; shaft heavier & more keeled (3), no. 6 depressed cotylae with irreg. outline (2),

Cyclorrhynchus about like Aethia but larger.

Ulna Aethia n. sp.

Resembles A. pusilla

18948 × undercut projection on ext. surface of distal end all alcids?
more rounded shaft than in most alcids, even
more rounded & less bladelike than Aethia
olecranon less prominent than some & straight across
at prox end (not extending prox'ly in a pt as in Plautus)

~~Between~~

Prox'ly - ext'ly a narrow depressed surface ~~between olecranon &~~
anconal to condyle adjacent to olecranon, with line
demarcated it ~~fr~~ distally. In Plautus this
area slopes immediately distally. Even more
marked in fossil than Recent pusilla or pygmaea

	fossil	A pusilla 61061	MVZ 134083
Length	28.0 mm	27.7	26.7
least br. sh.	1.7	1.7	1.7
.. depth ..	2.0	2.2	2.0
Br. prox condyles	3.9	3.7	3.7
Depth ext. dist	3.2	3.4	3.4
Br. ~~dist~~	3.1	3.0	3.0
depth sh. prox	2.3	2.7	2.4

Humerus

18949 Ectepicondylar process with prominent papilla-like process at prox tip, not well
dev'd below
shaft rounded, less bladelike, closest to Aethia but even more rounded
attach lig (int) facing almost directly palmad not slanted
laterally or distally - closest to A. pusilla

		a. pusilla	134083
Depth sh. same place	2.5	2.9	2.7
Br. sh. above ext. epi. papilla	2.5	2.1	2.0
Least br. sh.	1.8	1.7	1.6
depth same place	2.3	2.5	2.4
Br. across dist. condyles to ext. edge	4.1	3.9	3.7

T. mi. coracoids

Left: procoracoid is long and has foramen

~~projects~~

base of procoracoid attaches at int. edge (not in middle of post. surface as in alcidae that have foramen) more like Aeth.

		MVZ A. pusilla 61001	134083
Br across glenoid area	2.0	1.9	1.9?
br. sh below procoracoid	1.5	1.7	1.7
depth sh.	2.0	2.2	2.2

Alcidae, Laguna Hills, cont'd.

complete Ulna

Length $\overset{a}{30.9}$, depth prox $\overset{b}{7.6}$; Br. prox. $\overset{c}{5.6}$, mid sh. $\overset{d}{4.2 \times 2.9}$, depth dist. end exp. $\overset{e}{5.4}$; br. dist end $\overset{f}{5.45}$; br. dist tubercle → $\overset{g}{3.8}$

The short deep ulna, suggests the proportions of Pinguinus though only about ½ the size ($\overset{a}{58.7}$, $\overset{b}{12.7}$, $\overset{c}{9.9}$, $\overset{d}{9.5 \times 4.5}$, $\overset{e}{10.3}$, $\overset{f}{7.9}$, $\overset{g}{5.4}$) The stubby dist. process is also like Pinguinus.

Length is less even than auklets but girth of shaft is close to Fratercula & Cerorhinca

Compared to Mancalla ~~[illegible]~~ it is relatively more slender altho length is similar; olecranon is higher & more distinctly set off; olecranon very much like Pinguinus but area bet. olecranon & articulation is less deeply grooved than in Pinguinus. Internally the lig. attachment beside the artic. cotyla is clearly marked, short, & convex of surface (in most living forms it is flattened or even concave short in the smaller auklets & murrelets, longer in the larger forms, not discernible in Pinguinus; in Mancalla it is well excav'd below cotyla & surface is short distally but deeper from palmar to ulnar side.

shorter & broader in Mancalla very narrow in Pinguinus

Bicipital attachment short & deep long deep 8.1 × 3.2. Relatively much longer & narrower in living forms, Ext. cotyla not projecting palmad in sharp-pointed tip as in living alcids; closer to Pinguinus & Mancalla,

~~Two~~ One other ulnae may be of same sp. ~~[illegible] prox ½ [illegible],~~ 1 dist half. Chars. are same as described above. ~~Prox is slightly larger~~

7.4
38
3)11.6
9
26

Note, this ulna cannot belong with Pramancalla lagunensis, the humerus of which would take an ulna with breadth of prox end at least 2 mm greater,

Scapula

A right scapula has a larger, more curved acromion than the alcids but a more prominent coracoidal articulation than in the shearwaters

1.19.67 Alcid Bones from loc 1945 Laguna Hills

Coracoid

Three incomplete (upper) ends of coracoids. Best preserved has foramen below procoracoid; foramen complete (not a notch such as in Cepphus; position is closer to procoracoid than in Lunda, Fratercula or Cerorhinca (distance top of foramen to inner tip scap facet 4.4 mm, br. glenoid facet 4.4 + br. below head 4.4, 4.4, 4.3 fossil across at middle of glenoid facet 4.3; same meas. in Uria aalge #697 4.5, 4.9, 4.8; in Cepphus columba, 4?. 4.3, 4.1; Lunda 4.6, 4.4, 4.3; Cerorhinca monocerata, 6.0, 4.1, 4.0.

Relationships of alcids
① Alca, Pinguinus, Uria, Synthliboramphus, Brachyramphus + Endomychura, Cepphus
② Aethia, Cyclorrhynchus, Ptychoramphus
③ Lunda, Fratercula + Cerorhinca

In internal view this same Laguna Hills coracoid has acute ridge running from below head down int. margin, very close to anterior edge at head (no ridge visible below head in Fratercula or ~~Lunda~~ Cerorhinca Cepphus; more central in ~~[illegible]~~ Lunda; ridge in same position in Uria as in fossil) Size close to Cepphus (smaller than U. aalge, this character closest)

Tarsus

Length 21.1 from top of dist. foramen to lower muscle attach of prox end. (same in U. aalge #697, 21.1) least br sh. 3.5; also 3.5 in U. aalge 697. Only distinctive char is deeper ext side of shaft at level of hypotarsus 2.5 fossil, 1.8 U. aalge; shaft slopes more markedly anteriorly ~~at~~ as it proceed prox'ly in U. aalge, fossil more like Cepphus columba in this tho overall size larger (same ~~size~~ narrow broadening shaft however as contrasted, for example, with Cerorhinca Lunda & Fratercula)

Humerus coll'd 8.15.64

Length dist end to lower edge of ~~median tubercle~~ pectoral attach. 56.5 5.7 × 3.5 (dimensions of middle of shaft. Same meas. in U. aalge 697, 71.2, 8 × 4; Cepphus columba 1173, 55.7, 4.9 × 4; Cerorhinca monocerata, 55.25, 5.5 × 3.5. Distally the ridges on the ulnar face of the distal end have been ~~eroded~~ worn(?) off, but as there is no marked depression or groove ext'ly it is suggested that they were not well dev'd (as in Cepphus or Uria as compared to Cerorhinca or Fratercula & Lunda

~~Shape of dist. muscle attachments on ext side like Cepphus, but~~
~~[illegible] (as in Uria, Cepphus straight~~

prox'ly the int. tub. is more prominently jutted out from shaft (more like Uria)

	Coracoid	fossil	A. torda	Cepphus col.	Uria T. aalge
2 bones same # 18276	this br.	4.3 4,0	4,8	4,1	4,5
	Att to scap facet	13,8	14.5 14.8	12.5	15,2
18272	Ulna br prox	7.5	7,4	6.9	8,1
	brach. scar	11.4/3,8	11.9/2.7	12,3/2.0	14,7/3,0
18271 and 18273	Tarsus length	37	28, 33	36 369	37 40
	br. sh	3,6 3.9	3,4 3,7	2.7 2,8	3,4 4,2

replaced by yellow 26

Alcidae sp.

Five incomplete bones (two coracoids, an ulna (LACM 18274) and two tarsometatarsi (LACM 18273 and 18281)) may represent one species or three. The (LACM 18272) coracoids are broken so as to put the length of procoracoid in doubt, although indications are that it was short, and either lacked a foramen, or was notched as in some individuals of Cepphus; also similar to Cepphus is the slightly convex, rounded glenoid facet. The tarsometatarsi most closely resemble those of Uria aalge, but also bear some similarity to those of Cepphus, being relatively long and slender and lacking anterior depression of the shaft. The ulna is distinctive in having a relatively broader brachial impression than in any Recent genus.

Actual dimensions can only be estimated, but all specimens exceed those of Cepphus columba, ~~in size~~. The coracoids are closest in size to C. columba, and are considerably smaller than those of Uria aalge, or even Alca torda. The ulna, on the other hand, is approximately equal in breadth to that of A. torda. The tarsometatarsi come within the size range of those of U. aalge, and greatly exceed in length those of A. torda, in which the element is relatively shorter and broader than in either Uria or Cepphus.

Of previously described forms, the tarsometatarsi in Mancalla (LACM coll.) are stockier and have the anterior face of the shaft well depressed; ~~kkkkk~~ the type of Ptychoramphus tenuis has a slender shaft, but is anteriorly depressed, and, furthermore, is only half the size of the specimens from Laguna Hills. Coracoid and ulna are recorded for Australca grandis (Brodkorb, 1955), but these are not only larger than the Laguna Hills comparable elements, but the coracoid, as shown in Brodkorb's illustration (op. cit. pl. 8) has a well formed foramen in the procoracoid, and a long, oval glenoid facet. Miocepphus mcclungi is known only from humeri, which are shorter than those of Cepphus columba, suggesting individuals of smaller size than those represented by the Laguna Hills elements.

~~Cerorhinca~~? sp. C

#18274 Prox end of right ulna has the narrow brachial impression (narrower than Cerorhinca), found in ~~the~~ some Recent alcids, ~~& undercuts the prominence for anterior articular ligament (which facet~~ is Δ in shape) slightly as in Cerorhinca. Resembles C. monocerata in short ~~olecranon~~ olecranon (even shorter) & long triangular prom. for ant. artic lig. Brachial impression undercuts the prominence even more than in monocerata & seems relatively narrower; in these latter 2 respects more like Cepphus columba. Br. 6.2, depth 7.2 (Cer. mono, 7.1 × 7.8; Ceph. col, 7.3 × 7.8) ~~Cet~~ Cepphus Columba has more prominently pointed ~~olecranon~~. Lunda, Brachy., Ptycho. have short olecranon but brachial impression ~~does not~~ so doesn't undercut ant. artic lig. prom.

~~Praemancalla~~? small sp.

stet ~~New genus flightless~~?

Alcodes ulnulus n. sp. n. gen.

18277 Complete left ulna 30.9 long, br 5.7 × depth 7.5 prox. Characterized by deep but blunt ~~acromion~~ olecranon, short, broad brachial impression (7.7 × 3) 10.7 below cotyla which slightly undercuts ant. artic lig. attach., depth sh. 4.5 at dist end brach. imp., br. 2.9 7 (8?) feather pits on ext. face, 6 (7?) feather attachments along ~~ulnar~~ anconal ridge. 5.4 depth ext condyle, × 3.8 br across distal trochlea, Short, stubby carpal tubercle.

Type

18280 A large prox half ulna has brach. imp 8.5 × 2.9 (11.35 below cotyla 5.0 depth sh. at dist edge brach. imp. br. here 3.45. And a distal end 18279 depth ext 5.6 × br troch. 4.0 may belong to this genus. The prox seems too large for a small sp.

Ref. 18278 ~~Type~~ A prox end of carpometacarpus, Process of M1 only slightly more

br. troch b 3.7, ht M1 a × 7.2 (9.8 to troch), ext depth 7.0, dist. depth 8.0 Ratios ba 52% ac 91.3% bc 47.5%

Same meas. Praemancalla lagunensis b 5.2 a 14.0 c 11.9 ba 37.2% ac 117.2% bc 43.6%

ant'ly projected prox'ly than distally & ant border is nearly straight, ext crest of troch less extended prox than in Recent genera ~~M3 [illegible] & dist edge of int, crest of trochlea~~ dist. tip of dist. crest of trochlea merging into M3 without marked notch. Distal edge of ext crest straight & lacking outward lobe found in alcids; ext & int crests tending to converge distally (not parallel as in Rec.). Pisiform process less ant'ly extended than in Rec. Area post. to pisiform raised & ~~[illegible]~~ prominent lig. scar pres., Prox. end of prox symphysis well above level of dist. extent of proc. of M1. In all the above resembles Praemancalla but smaller & M1 rel. shorter (end of symph is about ½ way up proc in Praeman.

Cerorhinca?, A

prox end ulna size ~~as for~~ larger than Cerorhinca monocerata (depth sh 5.8; Rec 5.0) but similar in shape of brach. impression (not as long & thin as Uria Pro depth shaft about like Uria aalge (6.1), attach ant. art. lig. more prominent than in C. monocerata Possibly relates to 'coracoid listed as Uria? or Cerorhinca, too large for other ulna called Cerorhinca (?)

Alcidae El Toro 6.9.67

On the basis of ulnae there are 4 species

1 ~~Sp. A~~ ?1 Closest to Cepphus but dif. brachial impression (short & broad)
= B of coracoids? Largest of the ulnae.

Sp. C Smaller than A and narrower brachial imp.
Closest to Cerorhinca or Fratercula. Clearly different from A

X Sp. D Short as Aethia pusilla (almost) but distinctly broader
& deeper more keel like. Could be Praemancalla n. sp

X Sp. F Tiny ~~bone~~ the size of A. pusilla with narrow
shaft as in that species. But other distinctions

On the basis of coracoids, there are 3 sps. (doubtful if any coracoid = D)

? with what? Sp A? (possibly goes with ulna sp. A, size agreeable) P. lagunensis
how tie in to ulna? Shape of procoracoid & position of foramen suggest
a sp. of Uria (which the ulna doesn't)

Sp. B = ulna A actually more like Cepphus than the above so these (2)
may really go with ulna "sp. A"

X Sp. F = ulna F. 3 tiny coracoids size of A. pusilla or narrower, but
with long procoracoid & foramen ~~which~~ where A. pusilla differs
Probably go with ulna sp F above

On the basis of humeri 3 (maybe sp B coracoids)
sp A (for size) relationship not clear
X sp F with F above size & chars like A. pusilla.
sp C? Smaller than A but too frag. for any chars.
suggests sp C of ulna for size.

On the basis of carpometacarpi 2 sps.
X sp. D? possibly related to ulna "D"
X sp F " " " "F"

El Toro Alcidae 4.21.64 El Toro Alcidae

#① Prox end R ulna coll'd 12.24.64

Prominence for ant. art. lig. (above the brachial impression) is large, elongate as in puffins (Lunda & Fratercula) and Cerorhinca. The smaller alcids like Synthli, Brachy, Ptycho have a shorter prominence.

Brachial impression narrow, but depressed & slightly depressing beneath the prom. for ant. art. lig. (depression goes more prox'ly than in Lunda

Olecranon proceeds almost directly anconally from cotylae, with no proximal pointing tip. This is like Lunda. (check Fratercula & Cerorhinca

		Lunda cirrhata
Br. across cotylae -	6.2 mm.	7.8
Depth palmad-anconad	7.2	9.1
depth ext cotyla	4.9	6.2
" olecranon	3.1	3.8

Round depression on ext face of olecranon as in Lunda

#2 (1) Left complete & right distal ulna br 5.7 } prox depth 7.5 } 5.4 depth dist ext

7.1 × 2.9 dimensions brach. impress

Prox. has low, but rounded acromion (as Lunda) (Lunda pt'd) 5.2 × 3.0 sh well prox'ly 3.7 × 3.2 sh dist'ly

Prom. of ant. art lig. shorter than Lunda.

Brachial impression shorter & deeper (palmad-anconad) than any Alcidae at hand. Goes well prox'ly beside ant. art. lig prom.

#3 R. incompl. prox end ulna has similar shape of prom. & brachial impression to the above but has heavier shaft, 5.8 × 2.5 sh well prox'ly 8.3 × 2.7 length × depth brach. im.

#2 (?) Prox end carpometacarpus suggests narrowed form like ulnae #2

[illegible] M1 – narrow trochlea [illegible], [illegible]'ly

LACM loc.
1945 El Toro, 1 1/4 mi. SW of the town of El Toro, 1/4 mile north
of Aliso Creek, on the property of Leisure World Co.
upper Miocene, SW/4 of NE/4 of SW/4
Sec. 34 T 6 S, R 8 W, Orange Co., Calif.
San Juan Capistrano quad. Eaty, 1943
Top of hill so side Aliso C.

65119 E/2 of SW/4 Sec 34 etc
tan sand + phosphate pebble cong.

65120 graded surface 1/3 mi. SW of 65119, orange sand + phosphate pebble
cong. in 2 layers. On line bet. E/2 Sec 34, T 6 S,
R 8 W and Sec 3, T 7 S, R 8 W, Orange Co etc.

65121 1/3 mi SW of 65120 in NW/4 of NE/4 of
Sec. 3, T 7 S, R 8 W, Orange Co. etc
Orange crossbedded sands, fine gray silty sands
+ ~~diatomite~~ dome. San Juan Capis quad

Illustrate 19-20

P. calhounii
3 { ~~Humerus~~ 17508 P. calhounii palmar view
Ulna 17530 " " int. palmar view?
Tarsus 17582 " " ant + post views

F. hamnei
2 2 carpometa #? F. hamnei ext + int

Micrornula
3 { 2 humerus 17556 Micrornula anconal + palmar
tarsus 17554 " ? ant

2 { Musculus? radius 17568 1 view
subdat " 2 R? 1 view

4 { Alcodes ulna 2 views side + palmar
" carpus internal & ext?

5 sp.? cora. 2 humerus 1 ulna 2

1st fossil record of Fulmarus

Possible tie-in with other locs.

~~Sharktooth~~

P. priscus?

Microsula (willetti?) Lompoc & 2 others

Miosula? (media?) "

Morus lompocanus? "

Presbychen abavus Sharktooth

Os~~teodontornis~~ 3 locs.

New sp

P calhouni

F. hammeri

sp. ? alcid

new gen & sp

Alcodes ulnulus

Praemanc.

Dalk

November 18, 1966

RECAP OF INFORMATION re SITE NUMBERS of Los Angeles County Museum of Natural History as relates to Tract Maps and building numbers assigned in Laguna Hills Leisure World.

MUSEUM SITE #	Hill #	Tract	Lot	Unit #s of Bldgs & Strata Locations
Miocene 1945	1	5094	4	Strata runs in a line between Bldg 221 on one side and Bldgs 211 to 216 on the other side in a north-south direction; dropping approx 15° to east.
65119	2	5098	E/2 3	Southerly through east half of unit 641 past east side of Wash House to top of hill; thence south-easterly through Bldg 660. (Down 15° to east)
65120	3	5098	4	Southerly through Bldgs 664, 680, 679, 675; thence across Alhambra and southerly again along east curb line of Via Alhambra to a point near N.E. corner of Bldg 821. (Down 15° to east).
65121	4	5099	2	Southerly from S.E. Corner Bldg 822 through center of 801; thence south along east curb line of Ronda to Bldg 830. Prime area indicated by star at entrance to parking area 25292. (Down 15° to east)
65123	4	6034	1	Southerly in center of terrace parallel to street between Bldgs 847 toward 848; thence angling up hill southeasterly through wash house; thence south through embankment under entrance walks to Bldgs 858 and 857. (Shark vertebrae, etc) (Down 15° to east)
	3A	5099	3	Pocket under site of Bldg 829
	3B	5099	1	Strata runs easterly across Los Altos just south of via Los Altos (Drops 15° to north)

Appear to be at higher elevation than 1945 - probably Pliocene

W. Earl Calhoun

W. Earl Calhoun
625 West Avenue,
Fullerton, California

WEC/ec

Praemancalla lagunensis n. sp.
from Loc 1945 - Laguna Hills

Separate paper
LACM Contrib Sci # 101
1966

Separate
pub.
LACM Cont. Sci
#101 (1966)

Praemancalla

checked to copy 8.23.65

Table ~~7~~ 1, Carpometacarpus

	Praemancalla		Mancalla		Pinguinis
	Type	referred	Corona del Mar[a]	San Diego[b]	(2 specimens)
Length of process of metacarpal 1	14.0	14.1	16.6 - 17.7	15.1 - 15.4	12.3 - 13.0
Depth of proximal end through process of M 1 and internal trochlear crest	11.9	....	11.0 - 11.8?	10.5 - 11.0	13.9 - 14.1
Breadth of trochlea, proximally	63.4% 5.2	60% 5.0	60.3 64.7 4.8 - 5.1	56.5 43.7 4.6 - 4.7	65.2 70.7 6.2 - 6.5
Least br. trochlea (basal?) at base	3.3	3.0	2.9 3.3	2.6 3.0	4.3 4.5
Breadth of shaft of metacarpal 2	4.7 4.5	4.0	3.1 - 3.7	3.5 - 3.6	4.4 5 - 4.8
Depth of shaft of metacarpal 2	4.5	4.2	4.7 - 4.8	4.6 - 4.8	4.9 - 5.0 3
Ratio of length of process of M 1 to depth of proximal end	117.2	....	145.2 -159.0	137.0 -142.2	87.3 - 93.5
Ratio of breadth of trochlea to depth of proximal end	43.6	....	42.6 - 43.6	42.3 - 43.7	44.6 - 46.1
Ratio of breadth to depth of shaft of metacarpal 2	95.7 ~~100.0~~	95.2	65.4 - 78.3	75.4 - 78.3	91.8 90.6 88.8 - 98.0

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[a] Three specimens: LACM nos. 2578, 2033, 2583

[b] Three largest specimens, LACM nos. 2541, 2542, UCMP ~~Univ. Calif. Mus. Paleon.~~ no. 45861; specific assignment tentative.

DO NOT USE

Extent of external trochlear crest above tip of process of Metacarpal 1	3.0	3.2	3.2 3.6 3.2	3.2	4.8

Tables of Measurements and Proportions

Praemancalla lagunensis compared with *Mancalla californiensis* and *Pinguinis impennis*

(Measurements in millimeters, proportions in per cent)

8.23.65
checked to copy

Table 2, Humerus

	Praemancalla	Mancalla[a]	Pinguinis
	Paratype	(~~9~~ 10 specimens)	(2 specimens)
Breadth of distal end	7.8	6.5 - 8.0	10.3 - 10.8
Depth of distal end ~~through~~ internally ~~condyle~~	10.5	9.~~7~~6 - 11.2(~~3~~)	12.1 - 12.4
Distance from top of ectepicondylar process to distal extremity (externally)	15.3	15.5 - 19.8	16.2 - 16.3
Breadth of shaft immediately above ectepicondylar process	5.1	4.1 - 5.2	5.8 - 6.1
Depth of shaft immediately above ectepicondylar process	7.7	8.2 - 10.5	10.4 - 11.0
Ratio of breadth to depth of distal end	7~~3.4~~4,3	~~63.1~~ 62.5 - ~~71.0~~ 72.6	83.1 - 88.5
Ratio of breadth to depth of shaft	66.0	47.7 - 51.1	52.7 - 58.5

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[a] ~~Nine~~ Ten largest specimens from San Diego: LACM nos. ~~2296~~ 2688, 2304, 2480, 2481, (2 spec.) 2670, 2695, 6180; ~~Univ. Calif. Mus. Paleon.~~ UCMP no. 45856 (2 specimens); specific assignment tentative.

	br.	dist depth	
2670	8,0	11,0	72.6%
2481	6.5	10.4	62.5%
shorter 〃	6.5	10.0	65.0%
2304	6.7	9.6	69.8
2480	6.7	10.3	65.0
UC	6.8	10.5	64.7
smaller UC	7.4	11.2	66.1
6180	7.1	10.0	71.0
2688	6.8	9.9	68.7
2695	6.9	10.2	67.6

El Toro Mancalla

Carpometacarpus: Process of M1 relatively shorter than in other Mancallae 17% greater than depth of prox end as contrasted with 37-59% greater in the others; distal extent of int. crest of trochlea greater 46-48% of length M1 – 23.+25% Cor. del Mar, 31-35% S.D., over 50% Gr. Auk, 60% Uria; ~~pisiform process a thick well defined process, lacking in Alcas and its area broadly depressed with no appreciable change in level from process of M1~~

Internally, shaft & int. face of trochlear crest ~~M1 clearly demarcated from set apart from proc. of M1, by marked size~~ ~~int.~~ extended ~~radially~~ int'ly so that M1 is clearly set apart from the int of the bone; ~~ext~~ pisiform process a heavy, clearly marked tubercle; in Alcas demarcation of proc of M1 from ~~back of bone &~~ shaft & ext is very slight, pisiform process is lacking; More distinct separation between int. & ext crests of trochlea ~~are~~ posteriorly at their distal extremity, & int. more partly extends, but area narrow, not broad as in Gr. auk & Uria

int. contours much more marked than in others

distal extent int crest on M1

#2542
34.4
2541
31.8
2069-2545
33.4
20685
35.1
S.D

2533
24.6
2578
23.7
2573
25.3
Cor. del Mar

El Toro
46.5
48.9

Gr. auk
57

Uria
60.3

int & ext crests

Humerus (distal frag.) groove between ridge of ectepicondylar process and ext. condyle, resembling in this respect Uria & Gr. Auk as contrasted with other Mancalla fossils. But resembles Mancalla in great lateral compression across condyles & short prox extent of ext. condyle rel to ht of ectepicondyle. Shaft, however, is thicker & less deep

Coracoid, humeral facet broken but appears to be flatter prox'ly more extended internally, lacking downward bend int ~~shaft~~ edge of shaft below facet broadly rounded, there seems to be less ant. extent of head beyond the int. edge of shaft (thus nearer S.D. than Cor. del Mar in which latter form the int edge of shaft is quite angular & head extends ant to it, El Toro Mancalla vs. Uria & Great Auk

Carpometacarpus	a Length prox M1	b Depth int troch through M1	c Depth at base of ext troch. through M1	d Br. trochlea (max)	e MII Br sh below M1	f MII depth shaft below M1	Ratios ab	Ratio da	Ratio ef	g Ht from distal tip M1 to prox tip extensor	h Width troch at distal base	Ratio ag	Ratio hd	Ratio ga	
El Toro Aug. 1964	14.1	—	—	5.0	4.0	4.2		35.5	95.4	17.2	2.8	82.1	56.0	121.9	
El Toro Jan. 1965	14.0	11.9	11.2	5.2	4.5	4.5	117.2	37.1	100	17.4+	3.2+	80.3	61.5	124.2	
Great auk Left	12.3	14.1	12.3	6.2	4.8	4.9	87.3	50.4	98.0	17.6	4.9	70.0	79.0	143.0	120.7
Right	13.0	13.9	12.2	6.5	4.4	5.0	93.5	50.1	88.3	18.3	4.4	71.0	67.7	140.7	124.4
Uria aalge Bl 485	8.6	10.2	8.7	5.5	4.0	3.3	84.3	53.0	82.5	13.3	4.7	64.6		154.6	

New light on the Extinct Family Mancallidae

~~Introduction~~

The genus *Mancalla* was established by Lucas (1901) on the basis of a single incomplete humerus that obviously represented a flightless bird related to the auks. Over fifty years later, when nearly the entire skeleton of *Mancalla* had become known, Miller (   ) concluded that there was sufficient difference between Mancalla and the Alcids to warrant family separation, the family Mancallidae was established. To this time the family was known really only from the Pliocene. Neither ancestors nor descendants were known.

Recently in a deposit of presumed Miocene age a few mancalla like bones ~~assignable to this family~~ have appeared. The likenesses & differences of these bones to typical *Mancalla* greatly ~~strengthen~~ ~~the~~ Millers conclusion regarding the ~~and~~ ~~family des~~ establishment of the family Mancallidae while at the same time ~~indicating~~ necessitating the ~~presence~~ description of a second genus of that family.

As the characters of the family Mancallidae have not been described heretofore apart from characters of Mancalla the following comparison ~~with~~ Alcidae [illegible] is given by way of diagnosis

Family Mancallidae	Family Alcidae
~~Humerus~~ — anconal contour of shaft distally, straight	Shaft curves forward at distal end
Distal condyles compressed [illegible] and ext intercondylar groove ~~more~~ anconally placed than in [illegible]	Distal condyle more widely spaced & intercondylar groove about [illegible]; external [illegible]
Coracoid — Sternal end ~~straight~~ straight, sternal facet narrow	Sternal end markedly curved so that ext angle is directed somewhat posterior, sternal facet widened [illegible]
~~Coraco~~ humeral surface twisted so that uppermost edge is directed slightly anteriorly	Surface directed upward not twisted anteriorly
Glenoid facet slightly convex & slanting slightly ant'ly at upper end	facet nearly vertical or slanting slightly posteriorly

The family Mancallidae vs family Alcidae

Coracoid Alcidae

~~Lower end~~ – sternal facet (int. side)
with the broad ext flank + sternal process
curved posteriorly

upper end – coracohumeral surface
broad, directed upward at slight
angle to glenoid facet
glenoid facet nearly vertical
or slanting slightly post'ly at its upper end

procoracoid ~~extending~~ well downward on
shaft ~~with~~ pierced by foramen in Uria +
Cerorhinca – shorter in Cepphus (like small
Mancalla

Mancallidae

Sternal facet narrow
+ process directed strongly internally
not posteriorly

coracohumeral surface narrow +
twisted ~~slightly~~ so that ~~internally~~ at uppermost edge
surface is directed slightly
anteriorly; glenoid facet slightly convex + tending to slant
slightly toward anterior face
at upper end.

procoracoid seemingly more
weakly developed in ~~post~~ downward
extent (only one specimen
approaches alcid + has foramen
~~others~~ one shows marked
narrow projection curved inward, area broken
in most

Scapula

Acromium projected more abruptly
from shaft + slender + slightly
projected anteriorly.

Coracoidal + glenoid facets separated
no indentation in ant. contour of the latter

Ventral surface unevenly contoured
but not generally concave

blade slender

acromium rising gradually
from shaft + practically no
anterior projection, glenoid
facet convex, rather crescent
shape, blending with well marked
ball of coracoidal facet with
marked indentation of ant. contour
just int. to coracoidal facet

Ventral surface ~~[illegible]~~,
(slightly concave – more so in Mancalla than
new sp.) blade thick

Carpometa

Ext troch rel. long + narrow project well above M 1
Two crests remain nearly parallel post'ly at dist. extremity
M 1 curves so that dist tip is on int side shaft
Facet for digit 1 broad

Ext troch crest short but deep ant.-post'ly
not projected far above M1
Post'ly ext + int crests approach each other
M1 straight – doesn't slant toward
int. side
Facet for M1 narrow

New gen & species of Mancallid

Coracoid relatively heavier through glenoid facet & coraco humeral surface than in Mancalla, Trios. canal faces more ant'ly in Mancalla it faces decidedly posteriorly. In this respect El Toro more like alcids

Scapular facet larger; brachial tuberosity more markedly protruded over triosseal canal

	El Toro	Coronadel Mar	2310	2422	San Diego 2448	2289	2427
under scap facet to head	18.3	18.7	17.75	16.8	20.3	13.5	14.5
depth thru glenoid facet (laterally)	7.1	6.15	6.1	7.2	7.75	5.5	5.85
ant to post depth at scap facet	6.25	6.3	6.5	6.0	6.35	4.7	5.0
coraco humeral surface to greatest extent brachial tub.	6.45	6.17	5.8	5.65	6.85	5.4	4.8
least br. coraco hum surface	4.65	3.5	3.5	3.6	3.9	3.3	3.45
br. trios canal	5.95	5.8	5.8	5.4	5.85	4.6	4.75
greatest dimension scap facet	6.4 × 4.4	3.9 × 3.9	3.5 × 3.5 (4.0 × 3.3 #2067	4.4 × 4.1	4.8 × 3.6	3.6 × 2.7	3.8 × 3

Scapula

Poorly preserved (El Toro) but shape of glenoid & coracoidal facets suggest Mancallidae, blade thick, ventral surface tends to be concave but less markedly than Mancalla

Carpometacarpus

process M1 shorter, pisiform process prominent — (completely lacking in Mancalla

5.4.64

Humeri Mancalla

T lucae ~~with bridge~~

57)77.5 1.5
51
265
255

52)110.7 2
104

	a just above ectepi proc. Shaft br	b depth	c length to ~~mid~~ condi	d br dist condyles	~~ad~~ ratio br/depth sh	ad ratio	
El Toro	5.1	7.75	—	7.7.	65.6	66	4.8
Cor. del Mar	4.7	10.2	—	est 7.40	46.1	—	dist bet. 9.7 dist to [illegible] depth of ectepi
San Diego							
2670 prox gr. br. 12.0	5.2	10.7 depth 18.3	85.2	8.1	48.6	64	39,740 9 350
6182	4.3	8.0	73.6	—	54.7	~~65~~	
2304 mid 4.6	4.3	7.5 8.9	78.7	6.7	48.9	63	
2480 mid 4.5	4.5	7.7 8.9	74.9	5.6?	50.5	80	
2481	4.8	9.3	inc.	~~6.5~~	51.6	73	
2096	3.9	7.85	63.8	6.0	49.7	65	
2219	3.9	7.4	61.9	5.95	52.7	65	
2326	3.8	7.2	64.2	—	49.4	—	
2096	3.6	7.2	61.2	5.1	50.1	70	
2813	3.4	6.8	58.0	5.2	49.3	65	
Ty le Manc.	4.7	8.9			53.7		10.5 ap dist bet. deltoid & ectepi
" prox gr. sh.	breadth 10.7	ext depth 8.1	br prox 19.6	br delt. to [illegible] 7.8			
Cor. del Mar 2476 prox	10.7	7.9	or prox 19.4	7.4			

		length	br dist	dist TO end [illegible]
✓	2550	81.9	8.6?	51.7?
✓	2259		7.4	
✓	2209	71.6	7.1	with bridge
✓	2083	74.0	7.3	48.6
✓	2479	—	8.0	
✓	2851?	—	7.5	
✓	2681	—	8.35	56.0
✓	2177	50.8 [illegible]	8.9	
[illegible]	~~2100~~	—	7.6	
	2477	92.0	9.6	59.8
	2125	92.8	9.6	62.0
	2308	93.0	9.1	60.0
	—	—	9.1	no bridge
	2628	72.7	7.35	47.9
	2418	76.7	7.2	
	2549	77.0	7.5	50.7
	2286	77.3	7.1	
	2479	—	9.1	60
	2630	—	9.8	61.4
	2322	—	9.8	60.0
	UF 46015	98.6	11.7	61.8

smaller

1075 / 2848?

smallest [illegible] 44.8 (contra)

C del Mar ulna ~~[illegible]~~
depth 10.0 br. 6.5 prox end

prox br. from low prom. of capitulum groove to top of deltoid

Measurements ulnae from 65121 El Toro

	ext cond ~~to~~ top of condyle	~~ext~~ cond to lip of ext cot/c	~~ext~~ condyle to lip of int cotyle	Br prox condyle	Depth prox int	Depth prox ext	Depth prox across both condyles	Depth sh mid	Br sh mid	Depth ext side dist end	
	30.45	27.1	27.7	6.19	9.3	10.3	9.6	6.15	3.8	6.7	
	30.5	26.5	27.65	6.4	9.1	10.3	9.3	6.2	4.0	6.9	
	29.7	25.6	26.9	6.5	9.0	10.2	9.5	6.4	4.3	7.4	
3)	90.6	25.5	26.7	—	—	—	—	6.65	4.0	7.0	
	30.2	104.7 ~~26.1~~	—	—	—	—	—	6.5	4.2	7.0	
San Diego no # (new)	30.7	27.2	28.2	6.4	8.9	9.78	8.75	6.3	3.5	6.9	L
✓ 2323	29.7	25.9	26.7	6.5	9.0	10.2	9.35	6.3	3.8	—	L
✓ 2064	33.1	29.5	30.7	—	—	—	—	6.8	3.4	7.8	L
✓ 459859	28.7	25.5	26.3?	5.9	8.9	9.7	8.7	5.2	3.3	6.2?	L
✓ 2287	28.5	24.8	26.4	—	—	—	—	6.0	3.4	6.8	L
✓ 2337	—	25.5	26.8	—	—	—	—	5.8	3.4	—	L
broke 2257	—	25.0	—	—	—	—	—	5.2?	3.0?	6.0+?	L
2248	—	—	—	6.5	8.9	10.1	9.0	—	—	—	L
~~2069~~	—	—	27.3	—	—	—	—	—	—	—	L
✓ 2439	27.4	23.7	24.7	5.4	8.1	—	8.5?	5.6	3.4	6.6	
✓ r 2497	25.6	22.8	23.4	5.7	7.9	8.8	8.2	5.4	3.3	6.0	S
✓ l 2497	26.6	23.4	24.7	5.35	7.6	8.4	8.0	5.0	3.0	6.0	S
✓ 2082	26.2	22.5	23.5	5.4	7.6	8.7	7.9	5.2	3.1	6.09	S
✓ 2489	25.8	23.5	24.3	—	—	—	—	5.8	3.1 ✓	—	S
✓ 2552	25.3	22.1	23.2	4.8	7.5	8.1	7.7	5.6	3.2 ✓	6.3	S
✓ 4 2853	24.8	22.9	23.9	5.8	—	—	—	5.5	3.3	6.5	S
embryo 5854	—	21.6	22.5	—	—	—	—	4.4	2.8	—	S
embryo ✓ 2690	—	—	25.7	—	—	—		5.3?	3.4?	—	S
✓ 2179	25.4	22.5	23.25	5.2	7.5	8.0	7.5	4.6	3.0	—	S
✓ 2342	—	21.6	22.9	—	—	—	—	4.8	2.9	5.8	S
✓ 2019	24.5?	21.8	22.7	—	—	—	—	5.3	2.9 ✓	6.1	S
45642 ✓ 5519	26.6	23.4	24.4	4.9	7.7	8.6	7.5	5.0	3.1	6.2	S
6926	26.5	23.3	24.2	5.1	7.3	—	7.5	5.2	3.4	6.4	S

25.8

max-min 103%

30.7
29.7
33.1
28.5
4) 122.0
30.5

27.2 ✓
25.9
24.5
25.5 ✓
24.8
25.5
25.0
7) 183.4 (26.2
14
43
42
14

2 lish
2 lam

	ext length	int length	ext depth	
Large	28.5 (?)	24.8	26.3	max/min 116%
	33.1	29.5	30.7	
Breadth 1 mm	→ 1.1 mm		1.6	
	24.5	21.4	22.8	max/min 108%
small	27.4	23.7	24.7	
	(26.6)	23.5		

From W. Earl Calhoun — Bird bones
Incomplete unless noted otherwise

Received 7.21.65 — Locality 65121 (Site #4)

Flightless Auk of family Mancallidae
5 ulnae (3 are complete)
3 tarsometatarsi
2 coracoids
1 tibiotarsal fragment (identification ?)

Species ?
1 small carpometacarpus
1 " tarsometatarsus
1 " ulna (in 2 pieces)
2 " humeri (fragment)
1 distal end radius (possibly goose)
2 proximal ends femora (fairly large)
2 vertebrae
6 pedal phalanges
1 quadrate

Received 6.9.65
Loc. 1945 - 3 fragments of wing bone (shafts)
Loc. (MKH) 6502 — 3 " " " (")
1 " tarsometatarsus (shaft)
1 " coracoid
3, " questionably bird

Mancalla - El Toro bones (Dec. 1945)

Humerus Dec 1964 ("Hammer's part ?.)

Scapula " " ,

Carpus Jan 1965 misc

ref. " Aug 15, 1964 Hammer

Coracoid Jan. 1965 Muse.-dinero via contractor ?.

prox frag femur Jan 1965 " " " "

Co. del Mar - comp. carpus 1067/2578

ulna " 1066(3)/ 2583

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Table 2, Humerus

	Praemancalla ~~Type~~	Mancalla ~~Corona~~ ~~San Diego~~[b] ~~d 1 Mar~~[a] (~~8~~ 9 largest specimens from San Diego)[a]	Pinguinis (2 specimens)
Breadth of distal end	7.7	6.5 - 8.0	10.3 - 10.8
Depth of distal end through internal condyle	10.5	9.7 - 11.2 (?) ~~9.6 -10.1~~	12.1 - 12.~~3~~4
Distance from top of ectepicondylar process to distal extremity (externally)	15.3	15.5 ~~15.8~~ -19.8	16.2 - 16.3
Breadth of shaft immediately above ectepicondylar process	5.1	4.1 - 5.2	5.8 - 6.1
Depth of shaft immediately above ectepicondylar process	7.7	8.2 -10.5	10.4 - 11.0
Ratio of breadth to depth of distal end	73.4	63.1 - 71.0 ~~63.6 -69.6~~	83.1 ~~84.7~~ - 88.~~8~~5
Ratio of breadhh to depth of shaft	66.0	47.7 -51.1 ok	52.7 - 58.5

a ~~2304~~, ~~2480~~, ~~2670~~, ~~2296~~, ~~2481~~, ~~2695~~, 6180

✓45856 (2)

		dist		dist depth	br/depth dist
✓2304	78.7	(6.7)	4.4 x 8.9	(9.7)	69.0
✓2296		6.9	(4.1) x (8.2)	10.2	67.5
~~11~~	~~70.9~~	~~6.0~~	~~4.1 x 8.4~~		
✓45856	—	6.7	4.4 x 8.8 ✓	10.5	63.9
✓ "	—	7.3	4.7 x 9.6	11.2	65.3
~~6182~~	~~73.5~~	~~—~~			
~~45857~~		~~6.9~~	~~4.4 x 9.7~~		
✓ 2481		(6.5)	4.8 x 9.4	10.3	(63.1)
✓2480		6.5	4.4 x 8.7	10.3	63.1
✓2695	72.2	6.9	4.3 x 8.7	10.3	68.0
✓2670	85.2	(8.0)	(8.2) x (10.5)	(11.29)	(71.79)
✓4180	—	7.0	4.2 x 8.8	10.0	70.0

Tables of Measurements and Proportions

Praemancalla lagunensis compared with Mancalla californiensis and Pinguinus impennis
(Measurements in millimeters, proportions in per cent)

Table 1 Coracoid

Omit as table

	Praemancalla paratype	Mancalla Corona del Mar[a]	Mancalla San Diego[b]	Pinguinis (2 specimens)
Distance from head to below scapular facet	18.3	18.8	~~15.6~~ 16.2 - 19.~~8~~4	2~~5~~4.~~2~~4 - 2~~7~~.8 4.7
Least breadth of coracohumeral surface	4.7	3.4	3.5 - 3.9	5.3 - 5.4
least Breadth across triosseal canal ~~between glenoid and furcular facets~~	5.9	5.9	5.4 - 6.~~3~~1	6.9 - 7.3
Ratio of breadth of coracohumeral surface to breadth across triosseal canal	~~25.6~~	~~18.1~~	~~19.7 - 21.4~~	~~20.5 - 21.4~~
Ratio of breadth of coracohumeral surface to distance from head to below scapular facet	78.9	57.6	59.5 - 69.3	72.5 - 78.3
Ratio of breadth of triosseal canal to distance from head to below scapular facet	32.2	31.3	30.9 - 35.0	28.2 24.4 - 29.5 27.3

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[a] 1 specimen, LACM no. 2486

[b] ~~8~~ 5 largest specimens, LACM nos. 2498, 2067, 2310, 2422, ~~2290~~, 2087, ~~2849~~, and ~~Univ. Calif. Mus. Paleont~~ UCMP. no. 45863. Specific assignment tentative.

33.2 - 34.9
36.4

			16.4	18.2	90.1	13.65	14.35	95.90
17.3	18.7	93.5	16.5	18.4	89.7			
18.3	19.6	93.4	16.7	18.5	90.2			
18.55	20.2	91.9	17.0	18.9	90.1			
			17.45	19.7	88.6			

Cedros Id. Mainl.			Humerus	San Diego Mandible					Cor. del Mar		
	max br,	ht to mit tub		br	ht				br.	ht	
15388	17.8	10.3 (10.2) 57.3	7737	18.8	12.35 (12.6) 67.9				18.8	11.3	60.2
15367	18.5	10.7 (10.8) 58.4	2331	20.0	11.0 (11.7) 59.5			Type M. calif. CAST	19.6	11.4	58.2
15408	19.4	11.1 [illegible] 56.4	6182	18.4	10.4 (11.0) 59.7						
15382	20.3	11.25 (11.4) 56.2	2096	15.6	9.6 61.5						
			2670	20.2	12.9 63.8						
			2219	15.25	9.3 60.5						
			2813	14.4	9.2 65.9						

Measurements of Humerus

	Uria aalge	Pinguinus impennis (2 specimens)	Mancalla 8 largest specimens from San Diego		Praemancalla lagunensis type
Breadth distal end		10.3 – 10.8	6.5 – 8.0		7.7
Depth ~~dist.~~ con		1.12.3	9.6 – 10.1	9.4 10.4 9.5 11 10.1 9.9	10.5
Breadth of shaft immediately above ectepicond. process	sh. dimensions	5.8 6.1	4.4 – 4.7 4.1 – 5.2 4.7 cd.m. 10.2	4.1 4.8 4.4 4.2 4.7 4.4 4.3 5.2	5.1
Depth of shaft same place		11.0 10.4	8.2 – 10.5	8.2 10.5 8.9 9.4 9.6 8.8 ~~9.7~~ 8.7 8.7	7.7
Distance from top of ectepicond proc. distal extremity (~~ext~~ mally.)		16.3	15.8 – 19.8		15.3
Ratio b to depth dist. end		84.7 – 88.8	63.6 – 69.6	65.6 68.0 64.6 63.6 68.4 63.0 69.6	73.4
Ratio b to depth of shaft	49 51.1 50.4 47.7 49.5 50 49.5 49.5	52.7 – 58.5	47. 51.		64%

Coracoid			9 largest S.D.	Cdm. 2581	
a Distance from head to below scap. facet		25.8 – 25.2	15.6 – 19.8	18.8	18.3
b Least br. coracohumeral surface		5.3 – 5.4	3.5 – 3.9	3.4	4.7
c Br. across tris. canal below procor. part		6.9 – 7.3	5.4 – 6.3	5.9	5.9
ratio bc		72.6 78.3	61.9 67.3 60.3 62.3 59.5 64.9 70.3 66.7 59.5 – 69.3	57.6	78.9
ratio ba		20.5 – 21.4	19.7 – 21.4 19.7 22.9 20.0 21.8 20.7 22.6 22.5 22.5	18.1	25.6
Ratio ca			30.9 – 35.0		

31.8 33.1 34.9 30.9
34.1 35.0 35.1 33.9

Hunein 2270 dist
2296 "
45856 "
45857 "
6180 "

2304 comp,
2480 "
2695 "
2670 " (layout)

Cracards

Cdm 2581 inc

2422 comp
2290 "
2087 "
2849 "

2498 conte
5067 "
2310 "
45863 "
46028 " (eroded)

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11.0/4.8 43.6
11.7/5.0 42.4
? 11.8/5.1 43.3

10.8/4.6 UC 43.7
10.9/4.6 42.3
11.0/4.7 43.1

Table 3, Carpometacarpus

	Praemancalla Type	Praemancalla refer.	Mancalla Corona del Mar[a]	Mancalla San Diego[b]	Pinguinis (2 specimens)
a Length of process of metacarpal 1	14.0	14.1	16.6 - 17.7	15.1 - 15.4	12.3 - 13.0
b Depth of proximal end through process of M 1 and internal trochlear crest	11.9		0 11.3 11.1 - 11.7	10.5 - 11.0 10.6 10.9 - ~~11.2~~	13.9 - 14.1
b' Depth through ext. crest	10.1		9.3 9.5 10.2	9.3 9.8 9.4	11.9 11.5
c Breadth of trochlea, proximally	5.2	5.0	4.8 - 5.1 5.0	4.6 4.7 4.5 - 4.7 4.7	6.2 - 6.5
d Breadth of shaft of Metacarpal 2	4.5	4.0	3.1 - 3.7	3.5 - 3.6	4.4 - 4.8
e Depth of shaft of metacarpal 2	4.5	4.2	4.7 - 4.8	4.6 - 4.8	4.9 - 5.0
ab Ratio of length of process of M 1 to depth of proximal end	117.2	...	145.2 - 159.0	137.0 - 142.2	87.3 - 93.5
de Ratio of breadth to depth of shaft of M 2	100.0 ~~61.5~~	95.2 ~~56.0~~	65.4 - 78.3	75.4 - 78.3	88.8 - 98.0
Ratio c/b	43.4		42.6 43.3 ~~43.2 42.7~~	42.7 - 43.7 ~~42.5, 42.7, 42.0~~	44.6 - 46.1

[a] 3 specimens, LACM nos. 2578, 2033, 2583.

[b] 3 largest specimens, LACM nos. ~~2542~~ 2541, 2542, ~~2060~~x, Univ. Calif. Mus. Paleon. no. 45861. Assignment to M. calif. tentative,

x Ht of external trochlear crest above ~~proximal end of~~ process of metacarpal 1 at its proximal contact with carpus	3.5	3.2	3.5?, 4.2	3.7 3.6 3.5 - 3.9	4.7 - 5.5
Ratio x to b	29.4	—	31.5, 37.2, 31.6	33.0, 33.1, 33.07	33.8 - 39.1
" x to b'	34.6		37.6 44.3 - 36.2	37.7 36.8, 39.3	39.5 - 47.8
OK " b' to b	84.9 (88.2)		83.7, 84, 87.3 (86.0, 85.5, 88.0)	87.7, 90.0, 84.0	85.2 - 79.8 (84.3 - 81.6)

Table 1

Measurements and Proportions of Carpometacarpi

(measurements in millimeters, ratios in percent)

reverse order

	Uria aalge	Pinguinus impennis ③ 2 specimens	Mancalla ② californiensis (3 specimens)*	Praemancalla ① lagunensis Type	referred	M. S.D.
a Length of process of metacarpal I	8.6	12.3 - 13.0	16.6 - 17.7	14.0	14.1	15.1-15.4 12.5
b Depth of proximal end through process of M I and internal trochlear crest	10.2	13.9 - 14.1	11.1 - 11.7	11.9	....	8.8 10.6-11.2
c Breadth of trochlea posteriorly	4.7	4.4 - 4.9	3.0 - 3.2	3.2	2.8	2.4-2.9
d Breadth of trochlea proximally	5.5	6.2 - 6.5	4.7 - 5.1	5.2	5.0	4.5-4.7
e Distance from proximal tip of internal trochlear crest to distal tip of process of metacarpal I	13.3	17.6 - 18.3	20.5 0 21.3	17.4	17.2	18.6-18.6
f Breadth of shaft of metacarpal II	4.0	4.4 - 4.8	3.1 - 3.7	4.5	4.0	3.6 3.6 3.6
g Depth of shaft of metacarpal II	3.3	4.9 - 5.0	4.7 4.8	4.5	4.2	4.8 4.7 4.4
✗ Ratio of measurement a to measurement b	84.3	87.3 - 93.5	145.2 -159.0	117.2	....	137-142
Ratio of measurement c to measurement d	85.6	67.7 - 79.0	60.0 - 62.5	61.5	56.0	
✡ Ratio of measurement f to measurement g	121.6	88.8 - 98.0	65.4 - 78.3	100.0	95.2	75.4 76.1 78.3
Ratio of measurement e to measurement a	154.6	140.7 -143.0	120.3 -124.1	124.2	121.9	

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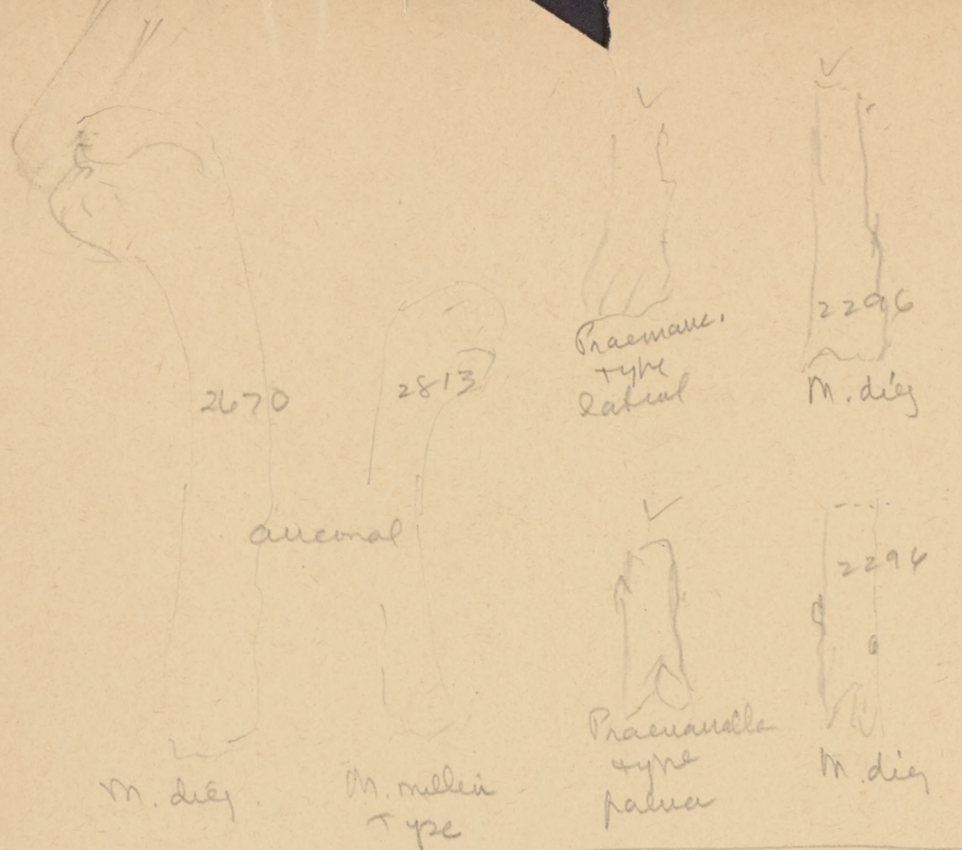
*All from Corona del Mar, Newport Bay Mesa, Orange County, California

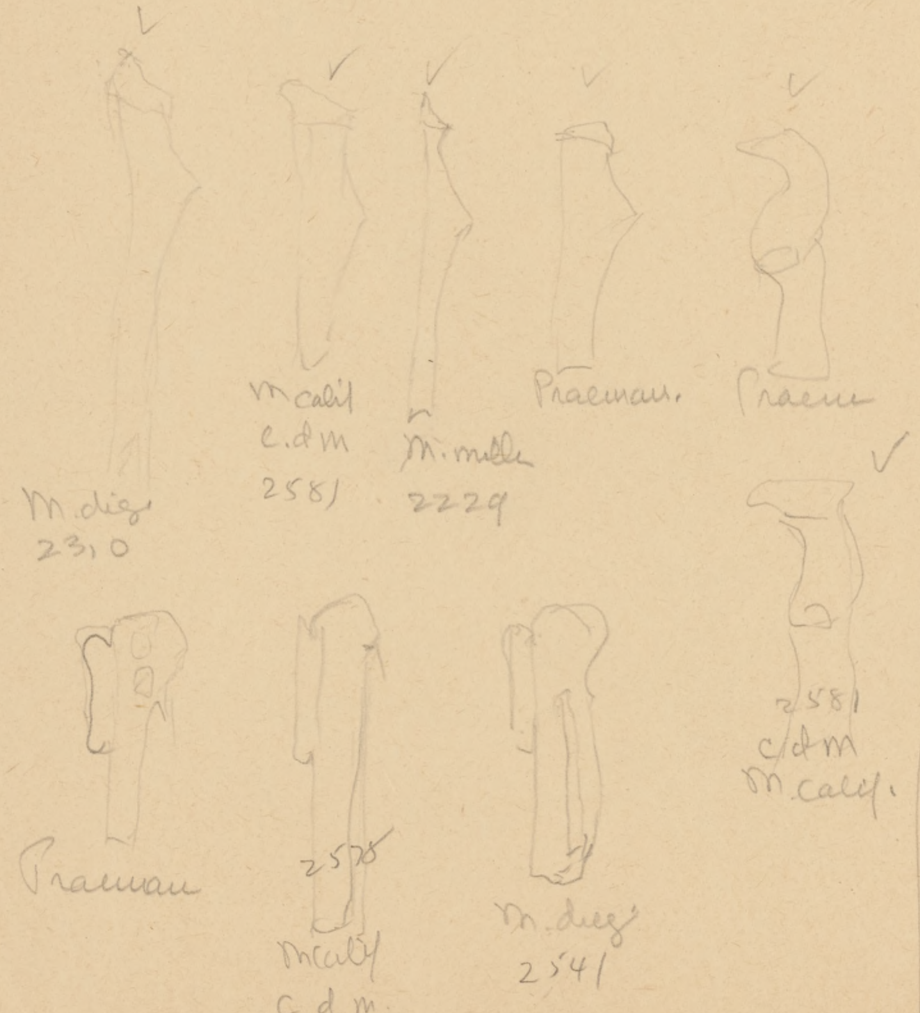
Table 1

Measurements of Carpometacarpi (in millimeters)

Uria
aalge



photos taken
7.10.65
by Brauer
2 each x 2
on mat paper



Literature cited

Mitchell,xxx Edw. D., Jr., and Charles A. Repenning
1963. The chronologic and geographic range of desmostylians. Los Angeles County Mus. Contrib. Sci. no. 78, 20 pp.

Miller, Loye, and Hildegarde Howard.
1949. The flightless Pliocene bird, Mancalla. Carnegie Institution Washington Publ. 584:201-228.

	depth to ext art. process	depth to across artic. surf.	to scoop artic surf. to int. art. proc.	length of artic surf. internally to tip of process	ba	cd	bc	dist from lower lip int. to upper edge ext. ⊗	bx
Uria 494	5.2	5.7	8.3	8.7	109.5	98.4	68.6	7.4	77.1
Manc. 2074R	8.0	7.4	8.5	11.1	92.5	76.4	87.0	8.8	84.2
2074L	8.1	7.3	8.4	10.7	90.3	78.5	86.8	8.6	84.7
2511	6.65	6.85	8.3	10.0	103.0	83.0	82.5	8.2	83.6
Brachyram.	8.4	9.1	10.5	11.4	108.1	92.3	86.4	10.2	87.6
Cerorhinca 504	6.4	6.5	8.1	6.4	101.5	126.2	80.1	7.0	92.3
Cepphus 1172	5.0	4.75	6.55	7.25	95.1	90.3	72.5	6.55	72.5

Referred material continued. (~~follows~~ pending) scapula

The fragment of lower mandible is worn or broken in significant areas, but is ~~seemingly~~ distinguished from the comparable portion of the mandible of *Mancalla* by ~~more rounded~~ less sharply angled ventral border, ~~with~~ less deeply excavated posterior surface, ~~[illegible]~~ and slightly more lateral thrust of internal articular process; ADD scapula

TO: Dr. Howard; [Fish from LACM 1945]

Most of the fish remains are fragments and vertebrae and are not identified. However on the basis of teeth the Sheephead (*Pimelometopon* sp.) was presence. A recent species of Sheephead is abundant in kelp beds and rocky areas off California today. 2 Kinds of ratfish (Chimaeridae) were also found. Ratfish (deep to shallow water) are similar to (skeleton of cartilage) both sharks and bonyfish but is often not grouped with either. Billfish remains (*Makaira* sp.) have also been collected from Loc. 1945.

about
as abundant
as any
Sheephead
good eating
Black head
& tail &
red stripe on
body
doglike teeth

Although I was unable to locate any in the collection I have heard shelly mention Porcupinefish (*Diodon* sp.), triggerfish (*Balistes* sp.) and the Parrotfish (sparidae) from Loc. 1945.

the Identifiable remains of fish although present, were not abundant and the above Identifications are based on only a few specimens.

Sturgeon (bony plates in collection) body armored

from: Richard Huddleston

at Laguna Hills – late Miocene

Imagotaria downsi? Sealion like walrus – (also from Sta Ana
" " " ")

Pithanotaria starri – fur seal
" " " "

Metaxytherium jordani – sea cow
Desmostylus

Dolphin Pithanodelphis n. sp. interocean with Belgium (other sp)

Lompoc like?
- Morus lompocanus?
- Sula willetti by size but referred to Miosula
- Miosula ?
- Cerorhinca (may be dubia by size)

P. calhouni

P. priscus ?

Presbychen abavus?

Praemancalla

Osteodontornis

2 Alcidae

1 more Mancallinae

Environment tropical to subtropical puffer fish (Diodon) and Triggerfish (Balistes) & parrot fish found at Round Mt silt Bakersfield "have their last Calif. fossil record in the sites at Laguna Hills."

Allodesmus kernensis? 1945?

Per 1945 "represent the most productive concentration of sharks teeth that have been found in western No. Amer. Here & in nearby Lag. Hills lrs, primitive genera; Squatina, Squalus, Heterodontus, Dasyatis, and undescribed genus of Echinorhinidae.

all sharks more tropical than today
- Myliobatis like M. californicus & another sp.
- Carcharhinidae had begun to dominate the fauna (2/3's of teeth) extinct & living sp. size range "less than seven feet."
- Blue shark at 1948 (Prionace glauca) small
- Hemipristis rare, very large teeth (some over 1 inch at base) Pero
- Tiger shark Galeocerdo aduncus
- 3 sp. Carcharodon – great white sharks oldest beds to have these modern sh
- Mako sharks numerous (Isurus) big enough to eat marine mammals (at the

Whale ? under horse

Desmostylus

[illegible] — 4 teeth

[illegible] — 16 pair of teeth

Notorhynchus 1 cow shark

Echinorhinus 1 [illegible] (12 teeth) spiny shark

deep water, not abundant

most abundant Isurus — Mackerel shark (get to 8–9 ft)
(? spp.)

Carcharodon — ~~giant~~ Great White shark
rare teeth 4–5 in long

Shark teeth Art
Jour 1536 – [illegible] Case ~~VI~~ – 12
[illegible] VI – 13
[illegible] VI – 13

[illegible] 1945 [illegible] Ward

2 kinds Mysticeti rib + 4 frags [Baleen]

Cetacea 9 frags including phalanx + 16 + rib + frag [illegible]

[illegible] molar [illegible] ([illegible])

[illegible] fur seal ~~[illegible]~~ same [illegible] [illegible] 4 ft long

All 3 teeth, phalanx frag [illegible] [illegible]

Allodesmus [illegible] sea lion [illegible]

Desmostylus teeth

Walrus (sea lion-like) related to allodesmus

Imagotaria 15 teeth calcaneum frag dentary phalanx femur (good)

Odobenidae convergent to walrus (not advanced phocid)

Otariidae 2 teeth vert. metacarpal frag calcaneum frag fibula frag metapodial frag + 35 more (including 4 more [illegible])

[illegible]
Scapula
6 rib frags large + 10 smaller frags.
frag [illegible] symphysis

Sirenia 17 large rib frags.

Beluga whale - white whale (dolphin

Hector [illegible] 4 teeth

Scaldicetus Sperm whale 1 tooth

4 kinds Dolphin sp.

Sea lion family (but no modern genera)
fur seal
allodesmus
~~Imagotaria~~
Imagotaria downsi Mitchell
Pithanotaria starri Kellogg - fur seal
Metaxytherium jordani Kellogg - sea cow

} Holotypes from Lompoc ref from [illegible] Hills

Pithanodelphis n. sp. - [illegible] Hills dolphin